MASSACHUSETTS WATER RESOURCES AUTHORITY

A Five-Year Progress Report for the Years 1990-1994

Prepared in accordance with Section 22(b) of
Chapter 372 of the Acts of 1984
December 31, 1994

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A Five-Year Progress Report for the Years 1990-1994

Executive Summary

"Not later than December thirty-first, nineteen hundred and eighty-nine and every five years thereafter, the Authority shall submit to the governor, the president of the senate, the speaker of the house of representatives, the chairman of the senate committee on ways and means, the chairman of the house committee on ways and means and the advisory board a progress report on the Authority's attainment of its statutory purposes. Each such five-year progress report shall be prepared by the Authority with the assistance of an independent citizen panel which shall include persons selected by the Authority and approved by the advisory board who are experienced in environmental protection, civil engineering and public management and finance. Said reports shall include recommendations concerning the future activities of the Authority, including, but not limited to, changes in the provisions of this act or the Authority's administrative procedures necessary or desirable for improving the delivery of services. The cost of preparing the reports of said Authority shall be provided for in the current expense budgets of said Authority."

-Chapter 372 of the Acts of 1984,
Section 22 (b)

Submitted
December 31, 1994

Executive Summary

Timeline of Major MWRA Events 1990-1994

Power Cable Installed at Deer Island To power construction, 70 megawatt power cable laid on floor of Boston Harbor.

Water Transport System Operational Full use of worker and equipment transport system allows large-scale construction at Deer Island to proceed.

Deer Island Pumping Upgraded Replacement of five pumps dramatically improves overall performance.

Water Pipeline Modernization launched Program set forth with the goal of renewing 5 miles of pipeline annually for the next 30 years.

Cambridge Systematics Economic Impact Report Study released estimating $1.9 billion in economic activity and nearly 10,000 jobs from Boston Harbor Project .

Commercial Point CSO Facility Completed Last of six planned miniature treatment plants begins screening and chlorinating sewage overflows near Dorchester beaches.

Treatment Plant Disinfection improved Safer and more effective chlorination system reduces bacteria violations in Boston Harbor.

Inter-Island Tunnel Construction Begun Mining crews start work on five-mile, sub-harbor tunnel to bring southern system flows to Deer Island.

Quabbin Overflows Demand management and heavy rainfall fill reservoir for the first time since 1984; demand is 257 mgd, well below safe yield of 300 mgd.

Leak Detection MWRA requires leak detection and pipe repair in customer communities.

Outfall Tunnel Construction Commences Digging begins for 9.5 mile ocean tunnel to disperse treated wastewater effluent in Massachusetts Bay.

Wachusett Requires Filtration; Quabbin Does Not DEP determines that despite purity of water coming to it from the Quabbin, Wachusett water will be unable to meet future standards without filtration.

MetroWest Tunnel New water supply tunnel receives initial certification from EOEA; supplementary reports begun.

New Executive Director Hired Douglas B. MacDonald takes over from Paul Levy as chief of MWRA.

Caruso Pump Station Complete One-hundred year old steam pumping station replaced by modern facility enhancing service in East Boston, Chelsea and Everett.

Clinton Treatment Plant Complete Operation of new advanced wastewater treatment plant serving three central Mass towns improves South Nashua River water quality.

Nut Island Headworks Contract awarded for replacement of Quincy treatment plant by a smaller screening facility.

Secondary Treatment Plant Begun Construction begins on secondary treatment facilities to bring MWRA discharges into compliance with federal standards.

Harbor Project Labor Agreement Upheld Pact preventing costly, labor-related work interruptions on Boston Harbor Project is upheld by U.S. Supreme Court.

Dual-Track Consent Agreement Agreement struck with EPA and DEP to pursue watershed protection in parallel with planning for some level of filtration at Wachusett Reservoir.

EPA Right Whale Assessment and NMFS Biological Opinion Regulatory agencies agree MWRA outfall not likely to harm endangered North Atlantic Right Whale.

DeLauri Pump Station Completed With replacement by new station, pumping capacity tripled from 31 to 93 mgd.

Sewer Metering Completed Installation of meters on customer community sewers provides fullest picture to date of when, where and how flows vary.

"Bay State Organic" Pilot Give-Away Program to provide local gardeners with free sludge fertilizer pellets struggles to meet overwhelming demand.

Zero Percent Rate Increase State debt service assistance and MWRA budget cuts results in first ever 0% rate increase.

Inter-island Tunnel Fire Fire in the conveyor system of sub-harbor tunnel results in temporary work cessation at both tunnels while safety systems upgraded.

Winthrop Water Line Adequate potable water for new Deer Island plant is made available by completion of four-mile, 24" pipeline through Winthrop.

Combined Sewer Overflow Plan Submitted Draft plan to correct frequent overflows of raw sewage to Boston Harbor and its tributaries recommends $1.3 billion worth of tunnel storage.

Deer Island Odor and Noise Control Systems installed to mitigate impacts on adjacent communities.

Long Range Water Supply MWRA concludes study and implements demand management program instead of pursuing new supplies.

Wastewater Advisory Committee Established Citizens' panel set up to give independent advice to the MWRA Board and staff on wastewater policies.

Primary Plant Construction Begun First half of new Deer Island treatment plant begun with completion expected in 1994.

Egg-shaped Digester Construction Commences Work begins on first eight of sixteen planned sludge digesters and storage tanks on Deer Island.

Sludge Discharges Ceased/ Pelletizing Begun Wastewater sludge that had been released daily on the outgoing tide is diverted to Fore River facility for heat-drying and use as fertilizer.

Deer Island Prison Demolition Begun Removal of Suffolk County prison makes way for treatment plant construction.

Watershed Protection Plan MWRA and MDC prepare plans to protect Quabbin and Wachusett Reservoirs.

Sludge Pelletizing Plant Fire Fire damage to newly completed plant causes temporary shutdown and overhaul of fire safety systems.

Hingham Pump Station Upgrade Complete Increased pumping capacity prevents overflows of raw sewage to Weymouth Back River.

I/I Grant Program Initiated Grant funding program launched to encourage the removal of unwanted water from regional sewer system.

"Cohen Bill" Passed Law brings new attention to protecting MWRA/MDC watersheds.

Sludge Suitability as Type 1 and Sludge USE MOU Certification within DEP's highest standard for sludge quality leads to Memorandum of Understanding with customer communities for pellet distribution.

Walpole Landfill Set Aside Commercial landfill capacity is substituted for a planned MWRA-owned landfill that would meet EPA requirements for back-up sludge disposal.

Operation Watersense Complete Retrofitting of plumbing fixtures in more than 360,000 households across the service area helps bring water consumption down.

A- to A Bond Rating Enhanced bond rating to save on MWRA bond interest costs over life of project.

Peat Marwick Report Independent review commissioned by state finds MWRA "has demonstrated effective overall management."

Draft CSO Plan Based on new sewer system data and more flexible federal policy, new plan lowers cost of system wide CSO control by more than a billion dollars.

$250 Million Federal Grant Increased federal grant funding for Boston Harbor Project cuts into long-term rate increases.

Wellesley Extension Sewer Replacement Complete Project to halt recurring overflows of sewage to Charles River reaches substantial completion.

Executive Summary

The MWRA's past five years of operation have seen tangible progress and achievement. Working together, the Board of Directors, staff, the Advisory Board, regulatory agencies, environmental and citizen groups, and elected officials have moved forward on repairing and rebuilding our critical water and sewer infrastructure. At the same time, real progress has been made toward the goals of MWRA rate relief. This report focuses on MWRA's work over the past five years in improving public health and the environment, keeping rates affordable, maintaining public confidence, and promoting workplace excellence.

As construction of the $3.5 billion Boston Harbor Project reaches its halfway mark, improvements in the sewage treatment process have already been made and the health of Boston Harbor has visibly responded. Sludge, the semisolid by-product of sewage treatment, is now recycled into fertilizer instead of being dumped into the harbor each day. Overflows of untreated sewage have been dramatically reduced by interim plant improvements and better operating procedures, and a planning effort is under way to stop many overflows completely. These and other improvements at MWRA facilities have resulted in harbor waters that are freer from bacterial and toxic contamination than they have been in decades, meaning fewer beach and shellfish bed closings and a healthier harbor and Massachusetts Bay ecosystem.

On the drinking water side, conservation, demand management and leak detection and repairs have been so effective that for the first time in decades, MWRA communities are consistently using far less than the Quabbin Reservoir's "safe yield" of 300 million gallons per day. Communities using this water are assured that it is clean and safe, and that the MWRA is pursuing ways to protect watersheds and improve water quality in keeping with the requirements of the federal Safe Drinking Water Act.

Efforts to cut costs and obtain rate relief have had the same vigorous attention as MWRA's efforts to maintain and improve its facilities and operations. Increased federal funds and a new state debt service assistance program have helped bring rate increases well below previous projections—to zero for FY95. The Advisory Board has required justification for every ratepayer dollar spent, and has also led the way to comprehensive reassessments of capital facilities which may yield savings as large as a billion dollars from previous capital spending projections. The Advisory Board, the customer communities, the legislature and MWRA have all cooperated, meanwhile, in developing a new and forward-looking sewer rate methodology.

The final chapter addresses the many continuing challenges yet to come. As the Boston Harbor Project and other construction activities yield billions of dollars worth of completed facilities, the MWRA faces new organizational challenges in operations and maintenance while stepping up rehabilitation of older components of the systems. Finishing the Deer Island Sewage Treatment Plant and finalizing CSO controls, fulfilling Safe Drinking Water Act and water system redundancy requirements, managing the consolidation and upgrade of water and sewer facilities, implementing the new sewer rate methodology and controlling future rate increases are just some of the issues the Authority will face over the next five years—all while meeting the most important challenge of all: justifying its customers' confidence in the quality of its services and the cost-effectivenss of its operations.

ACKNOWLEDGEMENTS

The MWRA prepared this report with the assistance of an independent panel, the members of which were selected by the Authority and approved by the Advisory Board. The members of this panel include:

Eugenie Beal, Boston Natural Areas Fund, Inc.

Mrs. Beal's long career in environmental protection includes working with the gubernatorial Committee on Pollution in Boston Harbor (the "Sargent Committee"), Massachusetts Environmental Affairs Secretary James S. Hoyte, and the Joint City-State Commission on Boston Harbor Beaches. Mrs. Beal was the first appointed chair of the Boston Conservation Commission and later became the first Director of the Boston Environment Department. She is president of Boston Natural Areas Fund, Inc.

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Dr. Ching is founder and president of Ching Associates, a private firm specializing in transportation planning. Since 1982 Dr. Ching has served on the Metropolitan Area Planning Council, most recently as Council President. Dr. Ching has also been elected to serve as the New England representative to the Board of Directors of the National Association of Regional Councils where he participates as a member of their Clean Water Act and Safe Drinking Water Act committees.

Mary Corcoran, K-12 Science Coordinator,Town of Winthrop

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Mr. Murphy became Executive Director of the Massachusetts Health and Educational Facilities Authority in 1989. The Authority is one of the largest issuers of tax-exempt bonds.

The Authority is grateful to all of these panel members for volunteering their time, energy and insights to assist in this effort.

Massachusetts Water Resources Authority
Five-Year Progress Report Panel

December 31, 1994

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Governor

Honorable William M. Bulger
Senate President

Honorable Charles F. Flaherty
Speaker of the House

Honorable Thomas M. Finneran
Chairman, House Ways and Means Committee

Honorable Thomas F. Birmingham
Chairman, Senate Ways and Means Committee

Mr. Andrew Pappastergion
Chairman, MWRA Advisory Board

This letter accompanies the Massachusetts Water Resources Authority's 1994 progress report to the Governor, the Legislature and the Advisory Board. The statute requires that a group of citizens be appointed to offer advice and assistance in the preparation of the report.

We eight, undersigned, represent the fields of environment, education, engineering and finance. We have had the privilege of working with Authority staff over several months as they prepared their report. We take this opportunity to tell you what this experience has taught us.

The report makes clear that Authority progress in its construction program is resulting in cleaner harbor waters, healthier for marine life and healthier for human harbor uses and all residents of the region. Residents of the MWRA service area, comprising 43% of Massachusetts' population are benefitting from improved water delivery and improved sewage disposal. In our urbanized society these services are vitally necessary.

The challenge ahead is to operate and maintain the new utility works at high levels of efficiency, in order to preserve the ratepayers' investment. This is best done by squarely placing upon the Authority the responsibility for delivering cost-effective service by continuing the Authority's independent standing and strong bond rating, and by educating future users/ratepayers so they will keep their water and sewer facilities at high levels of physical function.

Four legislative measures would benefit Authority ratepayers:

1. **Raise the statutory ceiling on Authority debt.** The State's 1994 management review of the MWRA (the "Peat Marwick Report") recommended raising the Authority's debt cap to $4.2 billion. Such action would send a good message to Wall Street and keep the issue independent of other Commonwealth budgetary matters.

2. **Transfer, with appropriate environmental safeguards, management of the watershed lands to the Authority.** The Authority ratepayers now wholly reimburse to the Metropolitan District Commission the expenses of management. They should have a say in how the watershed protection program is administered, particularly if sensitive management may mean the avoidance of a $200 million filtration facility.

3. **Move to end two special privileges afforded to the Town of Clinton** and paid for by Authority ratepayers. Clinton's new advanced sewage treatment plant was built and paid for by the Authority, which is still operating it for Clinton at no charge. Clinton pays nothing for the first 800 million gallons of water the Town draws each year. Clinton should now begin to pay for its water and sewer services on the same scale as all of the other Authority customers.

4. Cambridge Systematics estimates that $130 million in sales taxes and income taxes will be generated over the life of the Boston Harbor Project alone, paid directly to the Commonwealth. We are pleased to note that the Commonwealth's Sewer Rate Relief Fund appropriated $19 million in debt service assistance to the Authority in FY94 and $27 million in FY95. **More state funding should be made available to assist the ratepayers** in carrying the debt of the Boston Harbor Project, the MetroWest Water Supply Tunnel and other important projects that benefit the Commonwealth.

We commend the Authority's outreach to local schools in its service area and would like to see these and other education programs expanded so every student understands how water and sewer funds are spent, how water conservation helps and how the sewer system works.

No list of recommendations would be complete without an exhortation to the Authority to plan for the long term. What resources will be required in the future? At what cost? How can essential utilities be affordable to all ratepayers? These questions illustrate the challenges to the Authority that lie ahead. It is our hope that they will be answered with the same valuable input from citizens that has been at the core of the Authority's successes to date.

If this Five Year Progress Report Panel can assist you in any way, we will gladly make ourselves available.

Sincerely,

Eugene Beal

Franklin D. Ching

Mary E. Corcoran

David A. Fuller

Robert Kenney

Frank Lagrotteria

Ronald Long

Edward M. Murphy

MASSACHUSETTS WATER RESOURCES AUTHORITY
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Chairman, MWRA Advisory Board

The Massachusetts Water Resources Authority is pleased to submit this five-year progress report as required by Section 22 of its Enabling Act, Chapter 372 of the Acts of 1984. The purpose of this report is to describe the Authority's progress toward achieving the goals established by the Enabling Act. Simply put, these goals are to provide reliable, cost-effective, high quality water and sewer services that protect public health, promote environmental stewardship, maintain customer confidence and support a prosperous economy.

The Authority's first report, submitted in December 1989, five years after the Authority's creation, highlighted the many challenges the Authority faced as a start-up organization. These included keeping the water and sewer systems operating while developing a program, much of it under the supervision of the federal district court, covering all aspects of the operation and rehabilitation of the current systems and the planning, design and construction of major new facilities, especially the new sewage treatment plant on Deer Island. Other challenges included creating the administrative and financial systems to support the rehabilitation, maintenance and construction work ahead. During those early years, the Authority established financial controls for its expenses, revenues, assets and liabilities, and instituted capital planning, capital budgeting, current expense budgeting and performance monitoring processes.

All of these activities set the stage for the progress described in this report. The Authority's progress over the last five years includes improving the efficiency of its deteriorating water and sewer systems, ending the discharge of sludge to Boston Harbor, managing the security and safety of the region's water supply, and carrying out the construction of one of the largest wastewater treatment facilities in the United States.

Through the sustained attention of yourselves and others to the impacts of rising water and sewer rates, the Authority also made real progress toward the goal of rate relief. In FY94, thanks to the lawmakers and other constituent groups who supported the new state debt service assistance program, the constant attention by the Advisory Board to require justification for every ratepayer dollar spent, increased federal funding, and other rate relief efforts, the Authority was able to significantly reduce the increase in rates over previous projections. In FY95, in fact, the Authority did not increase its aggregate rates and charges at all.

While there is still much to accomplish, the Authority has made real progress over the last five years. With your help, we will continue our efforts to make sure that every dollar spent advances the ratepayers' demand for cost-conscious, effective management and improvement of our critical public health and environmental infrastructure.

Sincerely,

Douglas B. MacDonald
Executive Director

Massachusetts Water Resources Authority

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Prepared in accordance with Section 22(b) of Chapter 372 of the Acts of 1984

December 31, 1994

Board of Directors

Trudy Coxe, Chairwoman

John J. Carroll, Vice-Chairman

Lorraine M. Downey, Secretary

Robert J. Ciolek

Norman P. Jacques

Charles Lyons

Joseph A. MacRitchie

Manuel Moutinho, III

Samuel G. Mygatt

Thomas E. Reilly

Walter J. Ryan, Jr.

Executive Director

Douglas B. MacDonald

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DEDICATION

The MWRA staff respectfully dedicates its efforts to assist in the preparation of this report to the memory of five individuals who furthered the cause of restoring Boston Harbor and our urban ecosystem. They may be gone, but their spirit endures and their fine work is part of the foundation for all our future endeavors.

Jollene Dubner, MEPA Unit, Executive Office of Environmental Affairs, 1959-1994

Waldo Holcombe, Neponset River Watershed Association, 1911-1986

Paul Keough, Deputy Administrator for EPA Region I, 1946-1994

Theodore Mann, Mayor, City of Newton, 1922-1994

Dr. Herbert Meyer, Mystic River Watershed Association, 1895-1992

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INTRODUCTION

History

The Massachusetts Water Resources Authority was created by legislative act in 1984 to take responsibility for the water and sewer systems formerly operated by the Metropolitan District Commission (MDC). In July 1985, the Authority assumed control of those systems, including the right to utilize water withdrawn from system reservoirs. Ownership of real property was retained by the Commonwealth, including the reservoirs and watersheds which are under the management of the MDC Division of Watershed Management.

Since 1982, several lawsuits in state and federal courts have challenged the operation of the sewer system for its contribution to the pollution of Boston Harbor. In January 1985, the United States, acting at the request of the Environmental Protection Agency (EPA), filed suit against the Authority, the Commonwealth and the Boston Water and Sewer Commission for violations of permit conditions and certain terms of outstanding administrative orders previously issued by EPA. The case was consolidated with a pending federal court citizens' suit. In September 1985, the District Court found the MDC, and its successor the MWRA, liable for numerous Clean Water Act violations. In December 1985, the District Court issued a detailed compliance schedule, that it subsequently has modified from time to time, which governs the Authority's efforts to bring the system into compliance with Clean Water Act requirements.

Completed sewer system projects include major interim improvements to the existing but obsolete treatment facilities at Nut Island and Deer Island, the construction of a new sludge-to-fertilizer plant which allowed the Authority to cease dumping sludge into Boston Harbor in 1991, and other programs that have resulted in significant improvement to the water quality of Boston Harbor. The largest of the Authority's capital projects is the design and construction of the Boston Harbor Project, a $3.5 billion effort that includes new primary and secondary wastewater treatment facilities on Deer Island, a sewage conveyance tunnel connecting Nut Island and Deer Island and a new outfall tunnel to carry the treated wastewater effluent for eventual discharge into the deeper waters of Massachusetts Bay. Substantial progress has been made in the construction of the Boston Harbor Project, and the Authority is now completing and preparing to commence operations of a portion of the new primary treatment plant.

The Authority's capital program also includes projects mandated by the federal Safe Drinking Water Act (SDWA) and other improvements to the water system to assure continuous and efficient delivery of services, including leak detection and repair programs that have significantly reduced the loss of water from the water system and conservation programs to reduce water demand. Foremost in the Authority's efforts to improve the reliability of greater Boston's water supply is the design and forthcoming construction of the MetroWest Water Supply Tunnel to provide redundancy for the 53 year-old Hultman Aqueduct.

Governance and management

Board of Directors. The Authority is governed by an eleven-member Board of Directors chaired by the Secretary of Environmental Affairs for the Commonwealth. The Secretary and four other members are appointed by the Governor, two members who represent water resources protection interests (terms coterminous with the Governor)—one resident of a Connecticut River basin community and one resident of a Merrimack River basin community— a third member upon recommendation of the Mayor of Quincy and a fourth member upon recommendation of the Selectmen of Winthrop (each of the latter two memberships are for four-year terms). At least one of the five gubernatorial appointments must be a representative of a minority group. Three members of the Board are appointed by the Mayor of Boston (terms coterminous with the Mayor), and three are appointed by the Advisory Board (now for staggered two-year terms, in accordance with an amendment to the Enabling Act in 1994).

The first MWRA Board of Directors was sworn in on February 27, 1985, and its role is profoundly important to the Authority's success. Four of the Board's original members—Advisory Board appointees Charles Lyons and John Carroll and Boston appointees Lorraine Downey and Robert Ciolek—are still serving as directors. Four other members who joined the Board between 1985 and 1989—Joseph MacRitchie, Samuel Mygatt, Thomas Reilly and Walter Ryan—are also still serving as directors. Every dollar spent by the Authority on operations and capital improvements, including the Boston Harbor Project, must be approved by the Board according to the Enabling Act. The Board also establishes the rates and charges for water and sewer services that are assessed to each community.

In 1991, Susan Tierney took over as Chairwoman of the Board from former Chairman John DeVillars. Trudy Coxe has been Chairwoman of Board since 1993. Members who have joined the Board since 1990 include, Norman Jacques (1992 to present) and Manuel A. Moutinho III (1993-present). Members who have left the Board since 1990 include Patricia Crutchfield (1991-1993), Dr. William A. Darity (1990-1991), and Anthony V. Fletcher (1985-1992).

Management structure. The Authority's management structure currently includes an Executive Director, Deputy Director and Managing Director, five divisions for sewerage, waterworks, program management (Boston Harbor Project), finance and law, and a support services group. A chart illustrating the Authority's organization is included as Appendix 1.

As chief executive officer of the Authority, the Executive Director is responsible for the implementation and coordination of Authority programs, policies and procedures at the direction of the Board of Directors. In September 1991, Paul F. Levy announced that he planned to resign as MWRA Executive Director after serving over four years. The Board commenced a search process for a successor, and hired Douglas B. MacDonald, who took over in March 1992. The Deputy Director manages external affairs of the Authority, including its relations with the Advisory Board and the customer communities, and for activities in the areas of public affairs, real property and environmental management. The Managing Director undertakes the overall coordination of the support functions which serve the divisions, including human resources, management information systems, procurement, internal audit and central support services. The entire staff of the MWRA is responsible to the Executive Director although the affirmative action office also has a direct reporting relationship to the Board of Directors.

The Sewerage Division manages and operates the sewer system and includes wastewater engineering and construction, residuals management, environmental quality, and toxic reduction and control. The Waterworks Division manages and operates the water system and includes maintenance engineering and construction as well as capital engineering and development. The Program Management Division manages and oversees the design and construction of the Boston Harbor Project. The Finance Division includes treasury, rates and budgets, planning and coordination and capital grants management. The Law Division addresses the legal and regulatory issues involving the Authority.

Customer Communities. The Authority provides wholesale water and sewer services to 61 communities. Forty-seven communities purchase water services, and 43 communities purchase sewage removal and treatment services, 30 purchase both. Approximately 2.6 million people, or 43% of the population of Massachusetts, live and work in the communities that receive water and/ or wastewater services from the MWRA. A map of the service area is included as Appendix 2.

MWRA Advisory Board. The MWRA Advisory Board was established in the Authority's Enabling Act to function as a "watchdog" over the MWRA's budget and operations and to serve as a liaison between the Authority and the communities it serves. In addition to appointing three members of the MWRA Board of Directors and approving any service extensions, the Advisory Board is statutorily empowered to review and comment upon MWRA budgets. Its informed and professional reviews of MWRA spending, which have increased in sophistication and thoroughness over the past ten years, have given it a strong and effective voice.

Protecting Public Health and the Environment

Boston Harbor Project

State of the harbor. Over the past few years, substantial interim improvements to aging, outmoded sewage treatment plants have resulted in a much healthier Boston Harbor. The following are examples of the important environmental resources that the harbor now supports:

- Commercial and recreational fishing occurs throughout the harbor, including a lobster fishery valued at over $10.6 million per year and accounting for more than a third of all the state's lobster.
- One of the state's largest herring runs travels through the harbor and up the Back River to spawn, more than double the numbers estimated in the 1970s.
- Each spring and fall, porpoises return to the Mystic/Chelsea Rivers in the inner harbor.

Evidence of the improvements to the harbor's environmental health are harbingers of future restoration:

- Boston Harbor waters now meet water quality standards most of the time.
- The visual appeal of the water and beaches has significantly improved.
- The number of Boston Harbor beach closings has been reduced by 70 percent over the past four years.
- The biological diversity of species living on the sea floor has increased.

As the MWRA phases the new primary treatment plant into operation, even greater water quality improvements will result. Ultimately, new secondary treatment facilities and a new effluent outfall outside the shallow waters of Boston Harbor will benefit both the harbor and the bays ecosystem by providing improved pollutant removal at the treatment plant and improved dilution of treated effluent offshore.

"Fast Track" improvements to the existing treatment plants. While the long-term solution for the region's sewage treatment involves the building of a new secondary plant on Deer Island and the decommissioning of the two old plants, in the interim, the old plants must operate as efficiently as possible. Since taking over operation of the Deer Island and Nut Island treatment plants, the MWRA has spent over $100 million on intermediate upgrades or "fast track" improvements to virtually every stage of the primary treatment process. Some of these improvements mitigate impacts on adjacent communities, while others increase the plants' reliability and efficiency. One of the largest improvements, curtailing sludge discharge into the harbor, represents the most significant step yet taken in the environmental restoration of Boston Harbor. Recent harbor monitoring results indicate a sharp decrease in fecal coliform levels near the old sludge discharge site and throughout the rest of the harbor where the sludge was carried by waves, tides and currents (see Figure 1.1). Improvements to the existing plants since 1990 include:

1990 Odor and noise control systems installed to mitigate impacts on adjacent communities.

1991 A new disinfection system installed to provide more reliability and safer handling and storage of disinfection chemicals (disinfection system now uses sodium hypochlorite which is safer to store and handle than liquid chlorine).

1991 Digested sludge from the treatment plants no longer discharged to Boston Harbor

New Deer Island primary and secondary treatment plants. MWRA has made substantial progress toward the completion of the new primary and secondary treatment plants that are the centerpiece of the Authority's efforts to provide cost-effective and environmentally protective sewage treatment. After a decade of planning, design and construction, the Authority is in the start-up process of the first phase of the new primary treatment plant, including two batteries of 24 sedimentation and clarifier tanks, with a peak flow treatment capacity of 635 million gallons per day (mgd). Construction of these primary treatment facilities is more than 99% complete and testing is being conducted on thousands of instruments, pieces of equipment, and instrumentation and control loops. Construction is also under way on the second phase of the primary plant and the first two batteries of secondary treatment. The first major contract for the construction of the secondary treatment plant began in January 1993 and the second in August 1993. As heavy construction at Deer Island was gearing up five years ago, the Authority recognized four major needs:

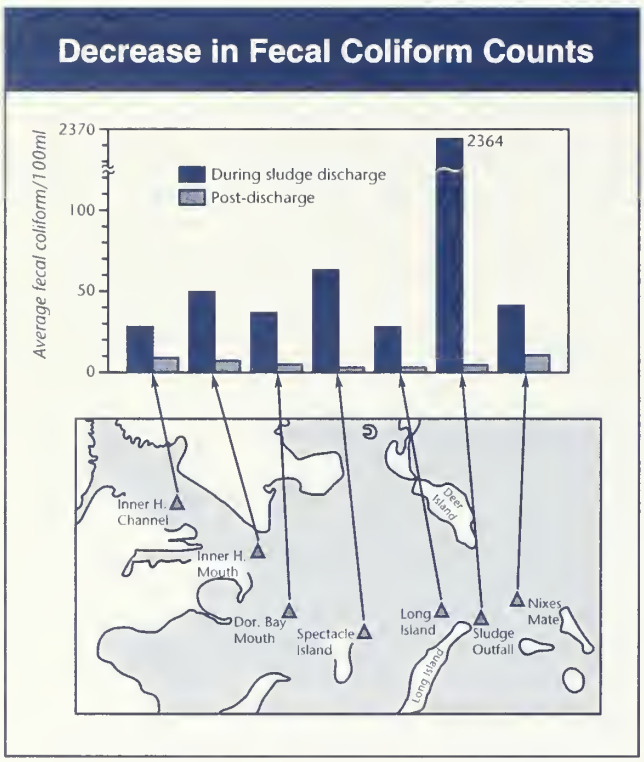


Figure 1.1

Water transportation—To facilitate the movement of materials and construction workers by water, the Authority built piers at Deer Island, Squantum Point and the Fore River Staging Area. Half of all project workers building the new treatment plant now travel to Deer Island by ferry from Rowes Wharf in downtown Boston and Squantum Point in Quincy. The project's remaining workers take buses from a remote parking area located at the Suffolk Downs race track in East Boston. The former Fore River shipyard serves the Deer Island construction site as a construction staging area and ferry terminal. Construction materials, supplies, equipment and vehicles are barged daily between Fore River and Deer Island. A new pier at Nut Island also allows bulk materials to be transported to that construction site by barge.

Power—To address the power requirement, a subsidiary of Boston Edison Company called the Harbor Electric Energy Company completed installation of an under-harbor power cable capable of providing 70 megawatts of electricity in May 1990. The Authority is also constructing an on-island power/thermal plant that will provide heat for the treatment facility and a 70 megawatt emergency power supply to back-up the five-mile under-harbor cable.

Winthrop water line—In October 1994 the Authority completed construction of a four-mile, 24" water main to supply adequate potable water for Deer Island operations. A two million gallon water storage tank on the island is substantially complete. Work is still in progress on a 20" return line to serve Winthrop residents and final roadway restoration. Years of discussion and controversy over the routing of the line, impacts on local streets and utilities, and sizing of the various facilities involved preceded the construction of this critical lifeline for the Boston Harbor Project and the Town of Winthrop's water supply.

Training—Staff from both the Sewerage Division, which is responsible for operating and maintaining the new Deer Island plant, and the Program Management Division, which is responsible for designing and constructing the plant, have been working together to implement a four-phased training program for more than 300 Deer Island staff. The first three phases of training have now been successfully completed. Plant training corresponds directly with phases of construction. Training programs are designed to prepare Deer Island employees for the new technology by addressing automated process control systems and operations, maintenance and laboratory information systems. In addition, professional development courses address the dynamics of

the rapid and profound changes that have accompanied the Boston Harbor Project, and the skills needed to function in a modern, high performance work place.

Deer Island design reassessment. In 1993 the MWRA began a study to reassess the overall capacity requirements of the Deer Island treatment plant necessary to meet Clean Water Act requirements. No other formal program-wide reexamination of the facilities had taken place since the completion of the Secondary Treatment Facilities Plan in 1988. This reassessment, commonly known as Design Package 29 (DP-29), represents a major opportunity for the MWRA to ensure that state and federal treatment and water quality standards are met, while potentially reducing capital and operating costs to ratepayers (see "Keeping Rates Affordable - Cost-effective capital facilities", p. 30).

Nut Island headworks. A $63 million contract to construct a new headworks on Nut Island in Quincy was awarded in July 1992. When completed, the new headworks will remove large objects, sand and gravel before conveying wastewater from 22 south shore communities to the new treatment plant on Deer Island. The Nut Island treatment plant, in service since 1952, will be demolished, making way for a new park adjacent to the Hough's Neck community. The headworks is scheduled for completion in 1995.

Tunnel construction. Construction is proceeding on two major deep rock tunnels, including a 9.5 mile effluent outfall tunnel and a 4.8 mile sewage conveyance tunnel (inter-island tunnel) connecting the new Nut Island headworks to the treatment plant on Deer Island. Building tunnels of this size and length is a very challenging construction undertaking. Tunneling contractors face a number of uncertainties which can make it difficult to forecast the cost and completion date of tunnel projects. Recognizing these uncertainties, the Authority awarded these contracts well in advance of the court-mandated milestone dates. Still, the contractors building the outfall and inter-island tunnels have encountered a variety of problems which have resulted in significant delays to both projects.

Since August 1993, construction on the inter-island tunnel has slowed due to water inflow, which required additional pumping equipment. Poor rock conditions at some locations have also required the contractor to install supports to stabilize the tunnel, and in some areas, rendered the tunnel boring machine ineffective and required laborious hand tunneling. In June 1994, a fire in the conveyor system of the inter-island tunnel resulted in a temporary cessation of work on both tunnels while additional safety equipment was installed.

In November 1993, the outfall tunnel contractor encountered a geologic fault which resulted in collapse of the tunnel face. This halted mining and required the contractor to stabilize the tunnel face before proceeding. The contractor has also experienced delays due to numerous mechanical breakdowns of the project's complex 700-ton tunnel boring machine.

As a result of these difficulties, the project completion date for both tunnels has slipped well beyond the original target dates. New likely completion dates reported to the federal court in November 1994 were mid-to-late 1997 for the outfall tunnel and well into 1996 for the inter-island tunnel, about 2 1/2 and 1 1/2 years, respectively, behind the original milestones. Despite these challenges, however, the Boston Harbor Project remains within amounts budgeted including contingencies, and the Authority remains committed to moving forward with the construction of both tunnels. The Authority is exploring every opportunity to improve progress without compromising its contractors' responsibilities for the means, methods and safety of construction.

A new discharge permit. The MWRA is responsible for ensuring that discharges from the Deer Island treatment plant (and currently the Nut Island treatment plant) meet the various limitations and conditions of its National Pollutant Discharge Elimination System (NPDES) Permit issued by EPA and the State Department of Environmental Protection (DEP). Because the limitations and conditions, including effluent requirements based on secondary treatment, cannot be met until completion of the new secondary treatment facilities on Deer Island, interim limitations have been established by federal District Court Order in the Boston Harbor case. Meanwhile, the Authority's

permit expired in March 1992, but remains in full force and effect pending the issuance of a renewal permit. The MWRA's renewal application was filed in September 1991 and was updated in June 1994. A new permit is expected to be issued by EPA during 1995 to cover operations of the new plant and outfall.

Challenges to the outfall. The location for the new outfall was selected in 1988 following facilities planning and environmental review by state and federal agencies, including extensive public participation from North and South Shore communities. While over the last two years, various Cape Cod groups have brought legal challenges to the construction of the new outfall, there is currently no case pending which threatens the completion of the new outfall. In May 1993 the Bays' Legal Fund, representing a number of Cape Cod communities, and Green World, Inc. sought an injunction to stop construction on the grounds that the procedures of the Endangered Species Act had not been followed at the time EPA approved of the facilities plan. In July 1993 the district court denied the injunction sought by both plaintiffs to stop construction of the tunnel. In September 1993, Stop the Outfall Pipe (STOP), filed suit in state court against the Authority and the state's Department of Environmental Management under the Massachusetts Ocean Sanctuaries Act, alleging that the Authority should have been required to apply for a variance for the outfall pipe, although it is located outside any ocean sanctuary. The case was reported directly to the Supreme Judicial Court which ruled in November 1994 that no variance was required. EPA released its biological assessment in April 1993, concluding that use of the outfall will not cause significant changes in nutrient concentrations in Massachusetts Bay, will not alter the food web, and will not discharge contaminants in amounts which would pose a threat to either threatened or endangered species.

In September 1993, the National Marine Fisheries Service (NMFS) issued its Biological Opinion, concluding that there was no evidence that the use of the outfall is likely to jeopardize endangered species or their habitat. As part of its Biological Opinion, NMFS also issued a number of conservation recommendations that would provide additional information and help to ensure that no adverse impacts would occur. The Authority is cooperating with NMFS and EPA in discussions concerning implementation of the conservation recommendations, including the development of a Contingency Plan for responding to and alleviating any unexpected trend toward environmental harm (see "Monitoring and Research," below).

Monitoring and research. The Authority's Environmental Quality Department monitors sewage influent and effluent quality and the resulting impacts on Boston Harbor. Since 1992, the Authority has also been monitoring water quality in Massachusetts Bay, in the area of the new outfall. The results of these studies, under direction of the Outfall Monitoring Task Force and conducted jointly with the Department of the Interior, United States Geological Survey (USGS) have improved the public and scientific community's knowledge of the sources and movement of contaminants released from Authority discharges as well as from other sources. The focus at present and over the next few years will be on the ultimate fate of these contaminants. This understanding will be essential in distinguishing the impact of the MWRA outfall from that of other sources.

Project Labor Agreement. In May 1989, the Authority's Construction Manager for the Boston Harbor Project entered into a project labor agreement with Metropolitan District Building and Trades Council. The Agreement contains various provisions governing all labor contracts for the Boston Harbor Project, including work stoppage protection and binding arbitration. Following both a lawsuit and appeal filed by a trade association, the United States Supreme Court issued a unanimous decision upholding the validity of the Agreement in March 1993. In a construction environment where a day's delay is very costly, labor harmony is a critical cost-control measure. This labor agreement has to date ensured that the project has not been interrupted by labor disputes.

Economic benefits. The Boston Harbor Project is one of the largest public works projects ever undertaken in New England. By the end of 1994, approximately $2 billion will have been expended on engineering, construction, and related contracts and the

current estimated total cost to complete the project is $3.5 billion. As the project is under construction, it is generating a significant amount of economic activity within the Boston metropolitan area, in terms of increased sales, employment, personal income and tax revenues.

In 1990, Cambridge Systematics, Inc. performed an economic impact assessment of the construction of the Boston Harbor Project using a sophisticated model of the Boston regional economy. In 1994, the Authority updated the findings of this study using current information on project costs and schedules. The key economic benefits generated by the construction of the Boston Harbor Project are summarized below.

- It is estimated that nearly half, or $1.6 billion, of total project expenditures will be purchased within the Boston metropolitan region. These expenditures will include hiring construction and support workers, purchasing materials and equipment from local suppliers, and the procuring of engineering and other services from firms within the region. Through the end of 1994, these local expenditures are estimated to have exceeded $1.0 billion.

- The $1.6 billion in project spending which remains in the Boston metropolitan area will generate an additional $1.4 billion in economic "spin-off" activity within the region, resulting in a total local economic impact of $3.0 billion. In total, the project will generate $1.9 billion in income to households within the Boston metropolitan region in the form of wages and other types of personal income.

- Between 1987 and 2001, the project will directly create an average of 1,500 full and part-time jobs each year. These jobs will be in construction, engineering and professional services, and industries supplying construction materials and equip ment to the project. In addition, spin-off employment will also be generated in other sectors of the economy as direct spending on the project circulates through the Boston metropolitan region. The project is expected to generate an average of 900 additional jobs per year in indirect and induced employment, resulting in an average total employment impact of 2,400 jobs per year.

- The project's economic impact peaked in 1994. During 1994, local direct expenditures reached $290 million and direct employment exceeded 3,900 jobs. Spin-off activity resulting from these direct impacts include a $250 million increase in sales by local businesses and the creation of an additional 2,000 jobs throughout the Boston metropolitan region.

- The increase in local economic activity resulting from construction of the Boston Harbor Project will generate an estimated $130 million in additional sales and income tax revenues for the Commonwealth of Massachusetts over the life of the project.

Toxic reduction and control

The control of toxics and other pollutants that enter the collection and treatment system is a critical element in the MWRA's overall wastewater program. Toxic discharges are of concern for a number of reasons, including impacts to treatment plants and workers, effects of effluent discharges on local water quality, and levels of pollutants that end up in the MWRA's sludge products.

Over the past several years, MWRA has continually refined its toxic reduction and control program (TRAC) in response to EPA's evolving requirements and the ongoing results of MWRA's water quality and sludge testing programs. Since 1984 there has been a 75% decrease in the total amount of metals in MWRA effluent (see Figure 1.2). A significant challenge remains in removing additional toxics from MWRA industrial sewer discharges, and TRAC must look at a variety of other potential contributing sources for further reductions. Highlights of the program's efforts and accomplishments include the following:

Improved data management. A powerful data management system was implemented in 1992, enabling TRAC to more effectively manage data and track compliance for the more than 1,400 industries it permits for discharges into the MWRA sewer system. By providing immediate notification on industry violations, this system is a major factor in TRAC's improved performance in issuing Notices of Violations (NOVs).

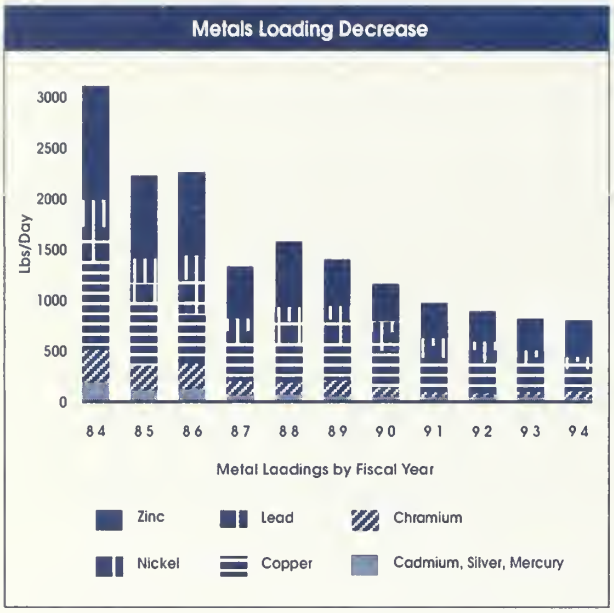


Figure 1.2

Aggressive enforcement. The issuance of NOVs to industries has increased from 0 in 1990 to more than 400 in 1994. A total of $2.7 million dollars in penalties was collected during the same period. These enforcement actions provide a strong deterrent to chronic and occasional discharge and/or reporting violations. NOVs also serve as a head-start for companies in addressing compliance problems before further enforcement actions leading to financial penalties are imposed.

Streamlined permitting. TRAC is working with DEP on the implementation of arrangements settled in 1993 by which DEP has delegated sewer connection permitting authority to the MWRA, saving time and money both for government and regulated industries. In 1994, TRAC developed a so-called "group" permit (one permit covering an entire industry) to provide continued environmental protection with reduced regulatory compliance costs for the photoprocessing and printing industries. This group permit will be used as a model for other industries as a part of TRAC's effort to focus program priorities and streamline the permitting process.

Recovered costs and new incentives. TRAC has implemented fees to recover the costs of the inspection, permitting and monitoring components of the industrial pretreatment program while at the same time encouraging compliance with discharge and reporting requirements. In fiscal year 1994, its first year, the program collected more than $1,600,000 from permitted industries, with a collection rate of over 97%. Enforcement action has begun against the few industries that have not paid their fair share of the industrial pretreatment program's costs.

Septage management policy. There are 20 municipally operated septage receiving sites located within the MWRA service area. TRAC began a septage hauler permitting program in 1993 that has resulted in improved control of septage discharged to the MWRA system. In addition, TRAC funded two grants to Wilmington and Needham to evaluate the feasibility of upgrading their septage receiving sites to regional facilities in compliance with all applicable regulations. The results of these studies will be used by the Authority and its customer communities to evaluate the possibility of implementing regional septage receiving sites.

Pollution prevention for industries, households. TRAC provides technical assistance to industries which are having difficulty complying with the MWRA's pretreatment requirements, either through its technical assistance group or through referrals to the state's Office of Technical Assistance. With TRAC's assistance, one local company with recurrent violation problems for pH and several metals was able to come into full compliance through pollution prevention techniques. Another industry which had been discharging as much as 15,000 gallons of hydraulic oil annually into MWRA sewers (without a permit) and losing over 30,000 pounds annually of perchloroethylene (a degreaser) was able to dramatically reduce the uses of these materials by installing collection and pretreatment systems and instituting a new, non-solvent based cleaning procedure.

In the past year, TRAC has moved to increase the level of technical assistance to industries through specialty workshops. One notable example is the recently-formed MWRA/Industry Mercury Products Workgroup to assist hospitals, laboratories and other industries facing mercury discharge compliance problems. Training for field staff in

pollution prevention techniques is also being used as a catalyst to spur the integration of pollution prevention into TRAC's inspection, monitoring and compliance activities.

TRAC also provides technical assistance to communities and households on reducing and disposing of household hazardous waste. With financial support from EPA grants, TRAC worked with nine communities to conduct pilot regional and single-community multi-day household hazardous waste (HHW) collections in 1991. As part of the report for that project, TRAC and the MWRA Public Affairs Department also produced and distributed a hazardous products alternatives and disposal guide. Between 1991 and 1993, TRAC also helped establish municipally operated used oil collection centers for 12 communities (see Table 1.1). In addition to providing residents with a convenient site for properly disposing of waste that might otherwise enter the sewer system, these programs also encourage a greater understanding that industries are not alone in impacting the quality of sewer system effluent and the marketability of fertilizer made from sewer system sludge.

Community	Established Used Oil Collection Center with help from MWRA	Participated in 1991 Pilot HHW Collection Program
Arlington*	X	X
Belmont		X
Boston	X	
Cambridge	X	
Chelsea	X	
Everett		X
Natick	X	
Newton	X	X
Malden		X
Medford		X
Reading*	X	X
Somerville	X	X
Stoneham*	X	
Wakefield*	X	
Watertown		X
Winchester*	X	
Wellesley	X	

Table 1.1

* Stonehom ond Wokefield work with Reoding to operote o regionol used oil collection center locoted in Reoding; Arlington works with Winchester to operote o regionol used oil collection center locoted in Winchester.

Combined Sewer Overflows/ System Master Planning

Portions of the Authority's service area have combined sewer systems that carry stormwater runoff in addition to sanitary wastewater flow. Under normal circumstances, all of the flow in combined systems is carried to the treatment plant. However, during many storm events, combined flows exceeding the capacity of the conveyance systems are diverted into nearby rivers and Boston Harbor through 81 combined sewer overflows (CSOs) located in Boston, Somerville, Cambridge and Chelsea (the so-called "CSO communities").

Reducing CSO volumes. Until recently, the problem of combined sewer overflows was exacerbated by mechanical breakdowns that limited the collection system's capacity to transport and regulate flow, which led to overflows even during dry weather. Today, the overall increase in system pumping capacity means that more of the flow can get to the treatment plants (see Figures 1.3 and 1.4. For more information on system see pages 14 through 15). Annual CSO discharge volume was reduced by 55% between 1988 and 1992. CSO activity during dry weather has been non-existent for the past two years.

Even routine maintenance work has reduced CSO activations: regular cleaning of the interceptor pipes improves transport capacity and creates more space to store wastewater in the event that the treatment plants are temporarily overloaded. Maintenance work on CSO structures by the MWRA and the CSO communities has had a similar impact. The Authority has completed several local CSO maintenance projects including

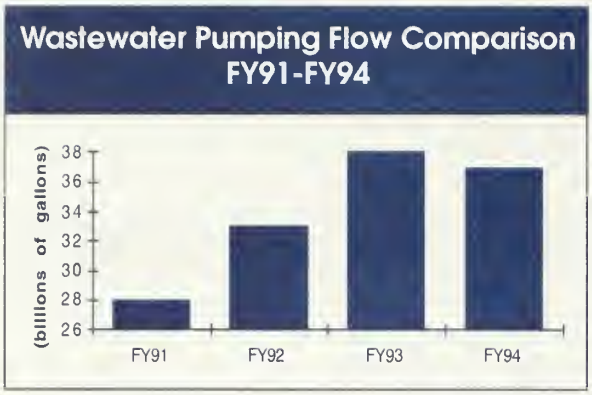


Figure 1.3

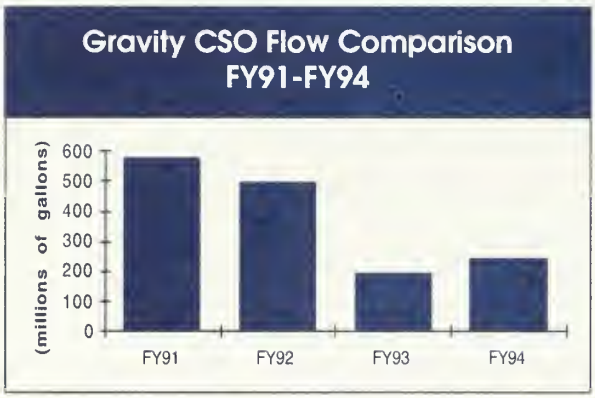


Figure 1.4

tidegate improvements in Chelsea and the coordination of sewer relocation work and diversion structures with the Massachusetts Highway Department in East Boston.

Long-term CSO plan. Within the last decade, the MWRA has spent millions of dollars to build or upgrade six CSO treatment facilities that screen and disinfect approximately 60% of the CSO flow before it is discharged. This effort included the Commercial Point CSO facility in Dorchester, completed in 1991. In 1990, under the federal court schedule, the MWRA completed a CSO Facilities Plan that proposed a regional tunnel storage system at an estimated cost of approximately $1.3 billion.

In 1992 the MWRA was involved in a national effort to revise EPA guidelines for permitting CSO discharges through the CSO Partnership, an organization founded by Authority Board member Charles Lyons and other members of the National League of Cities and Towns. Working with other CSO communities around the country, the MWRA lobbied for funding and a more cost-effective approach to achieving environmental benefits from CSO control. MWRA staff were among several Partnership members at the negotiating table when EPA developed its revised CSO policy. The resulting, more flexible national CSO policy and guidance, along with new information indicating lower CSO flows and the need to perform system master planning, led the MWRA to reassess the 1990 plan.

A revised conceptual CSO plan, released in the fall of 1994, demonstrated that CSOs can be more cost-effectively handled on a site-by-site basis rather than through a single system-wide approach. The proposed plan and an implementation schedule are yet to be presented to and accepted by the federal court. MWRA's new concept plan, with an estimated capital cost of approximately $370 million, uses a watershed approach to evaluate the relative contribution of CSOs in comparison with other pollution sources. Based on this evaluation, MWRA resources can then be prioritized toward CSO source controls that will yield the greatest water quality benefits, particularly in areas of swimming/recreation and shellfishing. Implementation of the plan will eliminate CSO discharges to Dorchester Bay, the Neponset River and Constitution Beach; reduce untreated overflows in each of 10 other receiving waters to an average of one to four times per year (versus the current discharge of up to 80 times per year in some areas); and upgrade CSO facilities at Cottage Farm, Prison Point and East Somerville, as well as construct additional CSO treatment facilities to increase control of bacteria and floating pollution to Boston Harbor and its tributaries. Figure 1.5 illustrates the significant impact of these and other CSO program improvements on system-wide CSOs.

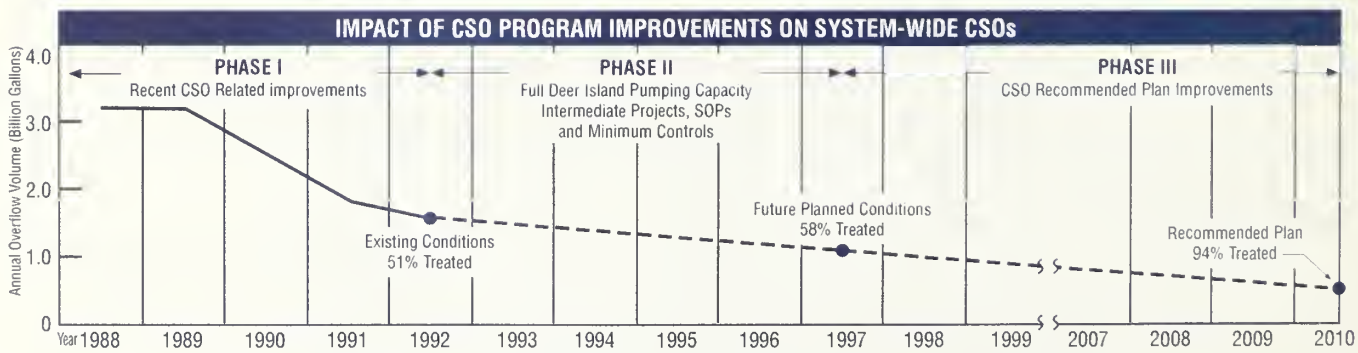


Figure 1.5

MWRA's new approach to CSO planning using a watershed perspective is in keeping with DEP and EPA CSO policy requirements and supports the goals of the Executive Office of Environmental Affairs' (EOEA) recently implemented watershed planning initiative. During wet weather, pollution sources throughout the entire watershed, including urban and agricultural runoff and drainage from highways, other transportation facilities and construction sites, combine with CSO pollution to cause violations of water quality standards. For many of the local CSO impacted receiving waters, CSO pollutant loads may be a small percentage of the total load, and control of CSOs may not result in measurable improvements on water quality or in attainment of beneficial uses.

For this reason, MWRA is committed to working with other government agencies and interested parties in developing plans for the control of these non-CSO sources of pollution. It is critical that these sources be identified and that parties responsible for their remediation be charged with implementing appropriate pollution abatement measures if water quality standards are to be met. To begin these efforts, in September 1994 the Authority's Board of Directors agreed to provide financial and technical assistance to the Charles River Watershed Association for a comprehensive five-year study and action plan for identifying and controlling pollution in the Charles River watershed which includes portions of 17 of the MWRA customer communities.

System Master Plan. In addition to the stormwater that enters the combined systems directly, stormwater and groundwater also enter indirectly, through infiltration and inflow (I/I) into pipes of adjacent communities. This extraneous flow uses up pipe capacity that would otherwise be available for combined sewage downstream. The recommended long term CSO plan was developed as a component of an overall System Master Plan (SMP) which also addresses I/I reduction, interceptor relief and secondary treatment. The SMP conclusions stem from integration of these strategy areas and the plan proposes an overall cost-effective program for addressing a range of system wide management needs.

The SMP concluded that an overall moderate level of I/I control will result from a variety of factors, including community infrastructure improvement and maintenance programs, the Authority's I/I Financial Assistance Program and the new flow-based sewer rate formula (for more information on the new sewer rate methodology, see page 49). The overall result will be to improve the condition of the community and Authority infrastructure and to preclude any additional increase in I/I flows within the system. The plan also noted that interceptor system improvements in addition to those projects already undergoing design and/or construction are needed. In addition, preliminary evaluations of secondary treatment capacity completed under the SMP support the conclusions of the Authority's Deer Island design reassessment (see p. 30).

System optimization. Long term planning of CSO improvements includes the development of a management and control plan which will seek to further reduce CSO discharge frequency and volume, to relocate CSOs to receiving water areas less vulnerable to water quality degradation, and to eliminate CSO flow where possible. In the meantime, a variety of low cost, easily implemented short term projects (known as System Optimization Plans or SOPs) were recently developed by the MWRA and are being implemented by the CSO communities with financial assistance from the Authority. The SOPs, which include tidegate replacements, CSO regulator modifications and abandonment of certain overflow pipes, are designed to maximize transport and treatment capacities of the existing infrastructure prior to designing and building new, capital intensive CSO facilities. These projects are expected to further reduce CSO discharge volumes by as much as 20%.

Residuals Management

In November 1992, EPA approved regulations covering the treatment and handling of sewage sludge, providing national standards for aggressive protection of the environment and public health, while permitting beneficial sludge reuse. In keeping with the letter and spirit of federal and state regulations, the Authority's sludge management program has moved from ocean dumping to beneficial reuse (see Figure 1.6).

Sludge-to-fertilizer plant. In December 1991 the MWRA began to ship digested sludge to its newly-opened $90 million sludge-to-fertilizer processing plant at the former Fore River shipyard, ending decades of sludge dumping into Boston Harbor. Digested sludge now travels by tanker barge from Deer Island and Nut Island to the processing plant where it is converted into fertilizer pellets.

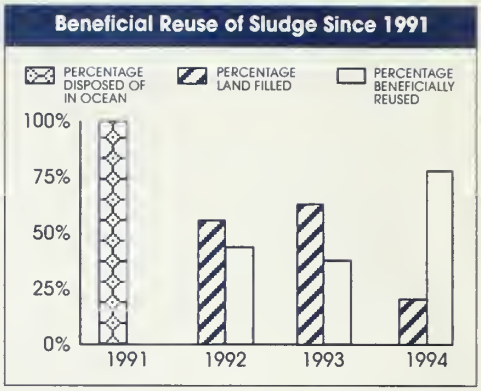


Figure 1.6

Barging, processing and marketing of the fertilizer pellets are currently the responsibility of New England Fertilizer Company (NEFCo). NEFCo is also responsible for disposing of any product that is not marketed. MWRA's contract with NEFCo runs through December 1995 but can be extended through December 1997 via four six-month extensions. Authority staff actively oversee NEFCo's operations. NEFCo ships MWRA sludge pellets for use in large-scale agriculture markets throughout the United States, where they are used "as is" or blended with other fertilizer ingredients to form a product tailored to specific agronomic needs.

In March 1993, DEP granted MWRA fertilizer pellets its "Approval of Suitability" as a Type 1 sludge product, the highest grade available. MWRA pellets could then be used on lawns, gardens, and agricultural crops. During the summer of 1994, MWRA sponsored a demonstration program to distribute "Bay State Organic" pellets free of charge in 40 pound bags for lawn and garden use. The response was so overwhelming that on several distribution days, demand for the product far exceeded supply. In all, more than 65,000 bags (1,300 tons) of MWRA fertilizer was distributed, much of it through joint programs with MWRA customer communities. Twenty-seven hundred customers participated in the free distribution program. Based on a user survey in August, 80% of the respondents said they would use Bay State Organic again; 42% would consider purchasing it at a commericial outlet, and 70% expressed a preference for the pellets because they are a recycled product.

Two significant shutdowns have occurred since regular operation of the processing plant began. The first of these was the result of a minor fire in one of the four pelletizing units on August 6, 1992. Pelletizing was suspended for a period of 15 weeks. The second shutdown of the pelletizer occurred from July 16 through August 12, 1993 for a total of four weeks.

Following the 1992 fire, a thorough review of plant operations by outside consultants, together with practical experience derived from daily operations, resulted in the identification of many operational and engineering improvements which could be made in the plant. Some of the improvements already implemented include process control changes to minimize the chance that future fires might occur, fire safety enhancements to better control fires if they do occur, and a nitrogen-based pellet inerting system to prevent the self-heating of pellets in the silos. Other improvements are being incorporated into the design modifications that will convert the present facility to its long-term configuration over the next few years.

Back-up disposal plan. In October 1993 the federal court overseeing the Boston Harbor case approved an alternative to the planned construction in Walpole of an in-state landfill for back-up residuals disposal. Unlike the original plan, the alternative relies principally on commercial landfill facilities. The accepted plan includes a long term contract with ECDC Environmental, L.C. in Utah to provide transportation and disposal capacity for all residuals for a 30 year period, an emergency preparedness plan for managing access to other commercial facilities should the ECDC facilities be unavailable, and continued MWRA ownership and permitting of the landfill site in Walpole should commercial disposal fail. Benefits of this alternative plan include much greater landfill capacity at the commercial disposal sites, increased reliability and flexibility for Authority operations and an acceptable accommodation with the interests of Walpole and neighboring communities.

The federal court order contained a number of conditions which the Authority must meet to ensure adequate capacity for back up residuals disposal and to avoid constructing the Walpole landfill. The court's acceptance of the back-up disposal plan closed what had been one of the most contentious chapters in the Authority's history and followed difficult decisions at the local, state and federal level.

Rehabilitation and maintenance of the sewer system

The MWRA's sewer system is designed to collect, transport, pump, treat and dispose of sewage from 43 communities. When the MWRA assumed control of metropolitan Boston's sewer system in 1985, it inherited an aging collection of pipes and pumps, many of which were still in service long beyond their planned useful lives. Deterioration from age and lack of maintenance led to numerous backups and overflows. Today, as a result of repair and replacement work to many of its weakest links, the MWRA sewer system is capable of collecting and treating greater flows.

Interceptor construction. Interceptors are the large MWRA pipes that accept sewage from smaller community sewers and transport it to either pump stations or treatment plants. Interceptor construction is a complex process, involving many years of planning, permitting and public participation. Projects often involve several communities, requiring MWRA to ensure that local concerns are addressed both before and during construction. Four major new interceptor construction projects are targeted to those areas where backups and overflows cause the most severe customer service, public health and environmental problems. Currently, most of these areas are located in the southern portion of the MWRA system (see Table 1.2). When completed, the new interceptors will not only improve the delivery of sewage to the treatment plant, but will also protect environmentally sensitive rivers, wetlands, and drinking water supplies by dramatically reducing backups and overflows.

Components and progress of major interceptor projects

Project	Communities Served	New Pipe (miles)	Repaired Pipe (miles)	Other Components	Cost (millions)	Progress
Wellesley Extension	Dedham Needham Wellesley	8.5	7.0	-	$ 66	Final rehab contract 97% complete
New Neponset Valley Relief	Stoughton Canton Walpole Norwood Westwood Dedham Boston (Hyde Park) Milton	8.8	-	New 46 million gallon per day (mgd) pump station	$ 23	Construction begun with four contracts awarded
Braintree Weymouth Relief	Hingham Weymouth Randolph Braintree Quimcy Holbrook	1.3	2.2	New 60 - mgd pump station New 13 -mgd pump station 2.9 mile deep-rock tunnel	$136	Design contract advertised and selection imminent
Framing-ham Extension Relief	Natick Framingham Ashland	6.8	4.3	New 22-mgd pump station	$ 46	90% completed design; collapse repaired; emergency repair contract awarded

Table 1.2

Since 1990, the Authority has engaged in extensive design and review of plans to upgrade the existing Framingham Extension Sewer (FES) and to supplement its capacity with an additional relief line (FERS) and an associated pump station. Inadequate capacity coupled with deterioration of the structural integrity of existing pipe has resulted in raw sewage discharges into the Charles River. MWRA is under an Administrative Compliance Order from EPA to complete the design of the new sewer line and pump station by February 28, 1995 and initiate operation of the new facilities by April 30, 1998. In early 1994, a longstanding controversy over the access route the Authority will use to construct the portion of the FERS passing through the Elm Bank Reservation in Dover threatened to hold up the project and invite a federal or citizens' lawsuit. Litigation was forestalled when the Authority assisted in developing compromise legislation which was enacted and signed into law in October 1994. Passage of the legislation, and local cooperation urged by the Charles River Watershed Association and local lawmakers, allowed the project to move forward while final aspects of the access question are resolved.

Pipe maintenance. MWRA is engaged in aggressive annual maintenance of Authority interceptors including manhole rehabilitation, interceptor cleaning and pipeline rehabilitation. In fiscal years 1990 through 1994 the MWRA allocated $5 million for pipeline maintenance and rehabilitation.

Regular internal inspections using video technology identify the structural condition of the Authority interceptors. This information is used to schedule preventive maintenance and pipeline rehabilitation projects. As part of the Authority's Community Assistance Program, internal inspections are also conducted on community sewer lines as requested. These inspections help the Authority's customer communities identify problems within their systems and ensure that the pipes do not fall back into disrepair once they have been upgraded. Figure 1.7 shows the miles of MWRA pipe inspected each year, which has been steadily increasing.

Pumping facilities. Over the past five years, MWRA has completed substantial repair and replacement of pumping station equipment at some of the system's most vulnerable points, including the antiquated Charlestown Pump Station and East Boston Pump Station, the underpowered Hingham Pump Station, and the Deer Island Power and Pump station, the system's largest (see Table 1.3). Since 1987, the Authority has also annually spent more than $250,000 on pump station maintenance. One indication of overall system improvement is the decrease in "choking time" at the Deer Island headworks (see Figure 1.8), the amount of time that flows that could not be handled and were "choked back" into the sewer system, which dropped from more than 5,000 hours in FY1987 to less than 1,000 hours per year in FY91 through FY94.

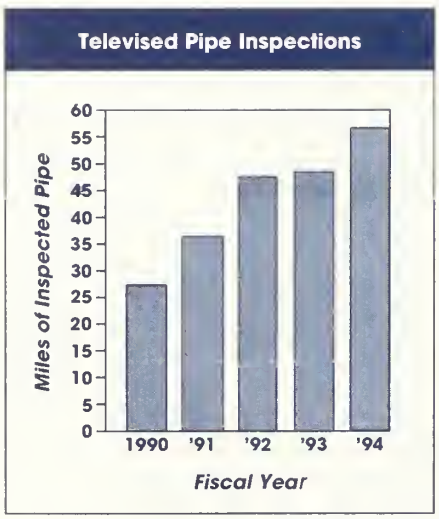


Figure 1.7

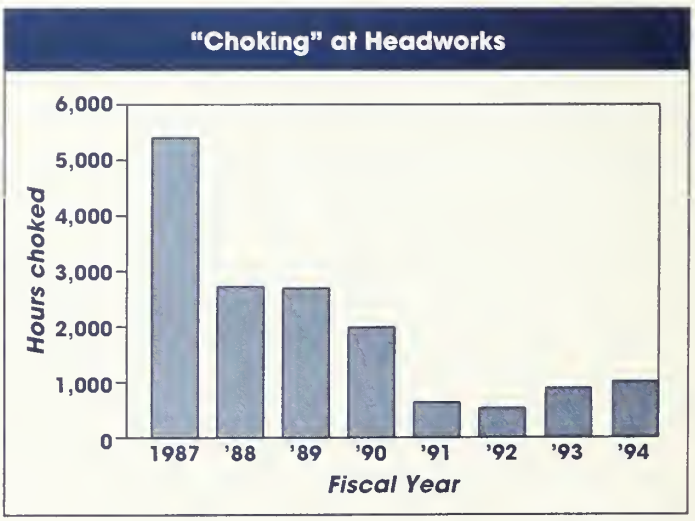


Figure 1.8

Components and results of major pump station repair and replacement projects 1990 - 1994

Year Completed	Pumping Location	Major Work Performed	Cost (millions)	Results
1990	Deer Island Power and Pump	Replacement of five of eight pumps and pump motors	$29	Improved capacity and reliability leading to better handling of high flows
1991	Caruso Pump Station (E. Boston) and Chelsea Screen House	New facilities constructed to replace East Boston Steam and Electric Pump Stations and the old Chelsea Screen House	52	Improved capacity and reliability to better handle all flow conditions. Also provides operational flexibility
1992	Hingham Pump Station	Installation of larger, more powerful pumps, "comminutors" and an emergency stand-by generator	2	Improvements have allowed Authority to permanently close off the bypass pipe that used to discharge the station's excess flow to the Weymouth Back River, thereby eliminating pollution from this source
1993	DeLauri Pump Station (Charlestown)	New facilities constructed to replace 100 year old pump station	29	Pumping capacity tripled from 31 to 93 mgd

Table 1.3

Metering program. In January 1994 the Authority completed construction of the permanent Wastewater Metering Program. Information generated by the program is used to perform regional system planning and modeling, identify local system I/I problems and to quantify I/I reduction resulting from sewer rehabilitation efforts. Flow data produced from the metering system will be a critical factor in implementing the Authority's new wholesale rate structure, and will help communities identify opportunities for reducing extraneous flows into their systems.

Repair Ends High-tide Influx

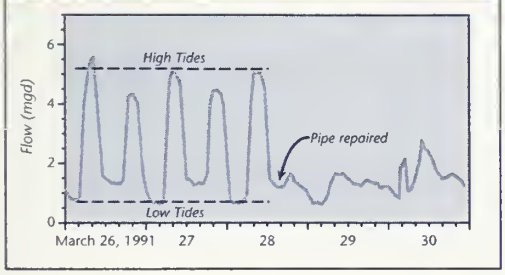


Figure 1.9

The new metering system already has proved effective in helping to identify and quantify extraneous flow sources. As Figure 1.9 shows, flow meter data from a site in Everett near the Mystic River identified a twice-daily influx of water coincident with the time of high tide. Subsequent investigations by MWRA and the City of Everett led to the discovery and repair of an old overflow pipe that was allowing water from the Mystic River to enter the sewer system at a peak rate of 4 million gallons per day (mgd). The meter record shows that the inflow was eliminated once the end of the pipe was sealed shut.

Infiltration/Inflow assistance program. The Authority's Infiltration and Inflow Assistance Program provides $25 million to customer communities to help fund local projects to reduce infiltration and inflow in local sewer systems. The two-year combination grant and loan program was developed with the help of the MWRA Advisory Board in May 1993. Funds are distributed for each approved community project as a 25 percent grant and 75 percent interest-free loan. The loan portion of the funding is then repaid by the community over a five year period beginning one year after the funds are distributed. Through August 1994, a total of $13,644,200 has been distributed to fund 47 separate projects in 30 communities (see Table 1.4).

Clinton Wastewater Treatment Plant. A wastewater treatment plant was built by the MDC in the 1920s as part of an agreement with the Town of Clinton to provide water and wastewater services in return for land acquired for construction of the Wachusett Reservoir. Ownership of the plant was transferred to the Authority in 1987. In 1992, the Authority completed construction of an advanced wastewater treatment facility at the original Clinton plant site in order to meet new, more stringent discharge limitations as a result of a remedial order entered in a case brought by the EPA. The $36 million plant, which discharges into the Nashua River, is consistently below its discharge limits.

Also in 1992, the legislature voted to form a regional sewer district to include Clinton and Lancaster and to transfer responsibility for plant operation and maintenance from the Authority to the newly created district. However, the Governor vetoed this bill and although refiled, it has not been brought back before the legislature for vote.

I/I Financial Assistance Program (Through August 1994)

Community	Funding ($1,000s)
Arlington	412.4
Belmont	228.8
Boston	3759.4
Braintree	397.1
Brookline	635.8
Cambridge	1,302.9
Canton	193.2
Chelsea	43.8
Dedham	25.0
Everett	424.2
Framingham	774.7
Lexington	332.6
Malden	167.7
Medford	674.9
Melrose	183.6
Milton	198.0
Natick	179.9
Newton	464.8
Norwood	349.3
Randolph	80.0
Somerville	274.5
Stoughton	252.5
Wakefield	285.3
Waltham	652.7
Wellesley	302.5
Westwood	129.6
Weymouth	333.0
Winchester	236.7
Winthrop	84.1
Woburn	119.0
Total	**13,644.2**

Table 1.4

Drinking water quality assurance

During the 1970s and 1980s, much attention was focused on the issue of drinking water quantity, due to concerns that the safe yield of the water system might not be sufficient to meet future demands. Fortunately, those concerns have been allayed in recent years as water conservation has helped bring demand down well below safe yield. In the 1990s, the major water supply issue confronting the MWRA is one of drinking water quality. While the water supply system, consisting of Quabbin and Wachusett Reservoirs, and the Ware River, has for many decades produced high quality water, circumstances now dictate that the water must meet even higher standards for quality and safety. The MWRA is committed to meeting or exceeding those standards through a multi-faceted approach which includes enhanced watershed protection, new treatment facilities, and distribution system improvements to preserve quality during delivery.

Progress highlights. Following the 1986 amendments to the federal Safe Drinking Water Act (SDWA), the Authority's initial efforts focused on assessing how the new standards would apply to the MWRA water supply system and what improvements might be needed to ensure continued compliance. These early planning efforts, which included the "SDWA Impact Study" in 1989, positioned the Authority ahead of most other water utilities and laid the groundwork for important progress in subsequent years. A chronology of this progress is presented below:

1990 MWRA began daily testing for coliform bacteria at both Quabbin and Wachusett Reservoirs to assess source water quality. Initial results indicated that Quabbin could probably meet the standard for non-filtration, but Wachusett might have difficulties.

1991 A two-year pilot testing program was started to identify suitable treatment methods for MWRA water.

1991 MWRA and MDC collaborated to prepare two Watershed Protection Plans (one for Quabbin/Ware and one for Wachusett). The Plans were designed to meet state guidelines for applying for a waiver from the filtration requirement.

1991 MWRA submitted the Quabbin Plan to DEP as part of the filtration waiver application. MWRA decided then not to submit the Wachusett Plan because filtration appeared unavoidable due to poor source water quality results.

1992 DEP issued its treatment determinations: Quabbin Reservoir was granted a conditional waiver from filtration, but Wachusett Reservoir water would require filtration.

1992 Source water quality at Wachusett Reservoir began to show improvement. Also, the Legislature passed the Watershed Protection Act (Cohen bill) to protect the system's supply sources. These positive developments prompted MWRA and other interest groups to urge DEP to reopen the question of whether Wachusett Reservoir could qualify for non-filtration.

1992 The Authority conducted two rounds of sampling within the service area to determine lead concentrations in first-flush samples from household taps. The findings indicated that MWRA water would have to be made less corrosive through installation of new corrosion control facilities.

1993 MWRA began conceptual design and environmental reviews for water treatment facilities for Wachusett Reservoir water. The Secretary of EOEA issued a certificate which established the special procedures to be followed in planning, assessing, and siting the new facilities.

1993 DEP, MWRA, and MDC negotiated and finalized an innovative Consent Order governing the manner in which Wachusett Reservoir and open distribution reservoirs would be brought into compliance with the SDWA. The Consent Order authorized a unique dual-track planning approach which allows the Authority until 1998 to demonstrate that Wachusett Reservoir meets the qualifications for a filtration waiver.

1993 MWRA and MDC submitted the Watershed Protection Plan for Wachusett Reservoir to DEP, as required by the Consent Order to pursue the non-filtration treatment track.

1994 DEP approved the Wachusett Watershed Protection Plan for implementation through July 1998. DEP also approved the MWRA's proposal for a demonstration water treatment plant.

1994 The Authority prepared interim assessment reports as required by the Secretary's certificate, and completed a Draft Environmental Impact Report for centralized water treatment facilities to treat flows from Wachusett Reservoir.

Safe Drinking Water Act requirements. The Safe Drinking Water Act establishes the nation's goals and standards for all public water supplies. It was amended by Congress in 1986 to achieve a greater degree of public health protection against potential contaminants, and to compel more aggressive oversight and enforcement by the EPA. As required by the SDWA, the EPA issued a series of new rules and regulations over the last five years, which are to be administered in Massachusetts by the DEP. Four of these rules are most significant for the Authority:

Surface Water Treatment Rule (SWTR)—Requires more effective treatment (disinfection and filtration) to eliminate microbiological contaminants from drinking water. Provides a process to exempt very high quality water sources from the filtration requirement.

Total Coliform Rule—Mandates that delivered water should contain no bacteria, as measured by total coliform. Requires increased sampling and testing, and more rapid public notification if exceedances are detected.

Lead and Copper Rule (Corrosion By-Products)—Requires treatment to reduce the water's corrosivity if lead levels are found to exceed 15 parts per billion (ppb) at more than 10 percent of the first-flush taps sampled.

Disinfectants/Disinfection By-Products Rule (D-DBPR)—Seeks to reduce long-term cancer risks by lowering the allowable concentrations of certain chemicals which form in the water when chlorine is used as a disinfectant. Due to scientific uncertainties, will be implemented in two stages to allow time for additional research and refinement by EPA.

Complying with both the SWTR and the D-DBPR requires a delicate balancing act by water utilities, because one rule calls for more potent disinfection while the other aims for drastically lower limits on the by-products of disinfection. Technological options available include switching to a non-chlorine primary disinfectant (such as ozone) or filtering out natural organic compounds which serve as the precursor materials for the by-products of concern.

Wachusett Reservoir treatment planning status. Under the terms of the Consent Order, the Authority must complete construction of new water treatment facilities for Wachusett Reservoir water by 2001. To meet this deadline, construction must begin by 1999. What is certain at this time is that the new facilities will have to include, at a minimum, disinfection and corrosion control treatment. These facilities are estimated to cost between $190 and $300 million, depending on the processes selected. What remains uncertain is whether filtration treatment would also have to be included. If filtration is required, the total cost of the new water treatment facility complex (including disinfection and corrosion control) would be approximately $400 million.

Preparations are underway to enable the Authority to begin construction of treatment facilities for Wachusett Reservoir water on time, by early 1999. Because the filtration question will not be settled until 1998, the Authority must be prepared for either scenario. Thus, the Authority is pursuing a dual-track planning approach. One track prepares for a water treatment plant with filtration, while the other track encompasses activities necessary to gain approval for a water treatment plant without filtration. Because the plant must meet the maximum daily water supply needs of the metropolitan service area, it will be designed to have a capacity of 450 mgd.

Beginning in 1991, an extensive site screening process was conducted to identify potential sites for centralized water treatment facilities in the region between Wachusett Reservoir and Sudbury Reservoir. After preliminary evaluations, five potential sites were thoroughly investigated to distinguish comparative advantages and disadvantages. Based on these analyses, a decision was made in November 1994 to recommend the Walnut Hill site, located on the borders of Marlborough, Northborough, and Southborough, as the preferred location for the purposes of the ongoing MEPA environmental review process. Public participation has been solicited and facilitated through a special Citizen's Advisory Committee and numerous meetings and forums with elected officials, citizen's groups, and community representatives.

Prospects for receiving a filtration waiver. The SWTR provides a means for states (with EPA approval) to grant filtration waivers for sources that are very pure and well-protected. To qualify, certain criteria must be met which confirm that unfiltered water delivered from the source is safe and in compliance with all standards. Although water quality at the Wachusett Reservoir intake has improved, it is still borderline. Furthermore, many tributary streams are affected by pollutants and its watershed is increasingly subject to real estate and commercial development. The Authority believes that Wachusett Reservoir's ability to qualify for a filtration waiver hinges on satisfying three key criteria necessary for filtration avoidance:

Source water quality conditions must be met— To meet this criterion, fecal coliform levels in the reservoir must be very low. Although Wachusett Reservoir failed to meet this standard from 1991 through 1993, a definite pattern of improvement has been observed. This improvement coincided with the implementation of an aggressive bird harassment program by the MDC which was designed to keep flocks of seagulls away from the intake area. This trend continued into 1994, and it now appears that Wachusett Reservoir has a fair chance of demonstrating compliance with the coliform standard.

Effectiveness of non-filtration treatment in meeting D/DBPR— Any treatment approach ultimately selected must be capable of producing finished water which meets the entire suite of SDWA standards. The lower future limits on disinfection by-products to be established by EPA will be particularly difficult to meet without filtration due to the natural character of the Authority's source water. These waters typically contain organic compounds which can react with disinfectants to form disinfection by-products. The Authority is continuing pilot treatment studies to investigate possible treatment alternatives and solutions.

Watershed control must be judged adequate by EPA and DEP— The general goals for watershed control are to maintain a relatively pristine environment and to control all sources of pollution which could potentially cause waterborne disease. Such goals are subjective standards, leaving much room for judgment and discretion by the regulatory agencies. A high degree of land ownership by the water supplier is strongly encouraged, but recent decisions by EPA indicate that complete ownership is not essential if other types of controls are in place. While DEP has approved the Wachusett Reservoir Watershed Protection Plan, EPA has expressed some concerns about the ability of the MWRA/MDC to achieve acceptable watershed conditions by 1998. It appears that gaining EPA's confidence in the effectiveness of watershed control will be a major challenge.

Role of watershed protection. The Authority considers watershed protection essential to the safety and purity of the drinking water supply, both for today's consumers and for future generations of users. The Watershed Protection Plans for Quabbin and Wachusett Reservoirs are designed to provide and maintain appropriate environmental conditions in the watershed areas so that these areas can yield high quality water to the reservoirs. Successful implementation of these plans, and a continued commitment to watershed protection, will enable the Authority to minimize future treatment costs. Many factors have contributed in recent years to significant progress in the area of watershed protection, as evidenced by the following accomplishments:

- Enactment of the Watershed Protection Act by the Commonwealth in 1992 to establish special land use controls on lands within 400 feet of the system's reservoirs and tributaries. The Act also authorized funding for land acquisition at a rate of $8 million per year.

- Development and promulgation of regulations by the MDC in 1994 to implement and administer the Watershed Protection Act.

- Creation of an Environmental Planning Section within the MDC to provide technical assistance to watershed communities on appropriate local development strategies.

- Purchase of nearly 2,600 acres of land in the Wachusett watershed by the MDC since FY90, increasing MDC land ownership to 12 percent.

- Development of a draft Wastewater Facilities Plan by the MDC for portions of West Boylston and Holden where old, failing septic systems allow contaminants to seep into nearby water resources. The cost to build sewers to replace more than 3,000 on-site septic systems is estimated at $50 million.

- Significant reductions in fecal coliform levels at Wachusett Reservoir have been achieved, due primarily to aggressive measures to discourage flocks of birds from roosting at the northern end of Wachusett Reservoir.

The Authority is also planning to work with the MDC in 1995 to develop an appropriate watershed protection plan for Sudbury Reservoir, which is no longer in regular use, but remains available as an emergency water source for the MWRA system.

The MDC Division of Watershed Management (DWM) has the important responsibility of managing the watershed areas and source reservoirs which supply the MWRA water system. Currently, the MWRA directly supports and funds the activities of the MDC by reimbursing the Commonwealth annually for 100% of the costs incurred by the DWM. While the original Enabling Act called for the MWRA to pay a 50% share of watershed costs, a legislative amendment in 1990 raised the MWRA share to 75%, and another amendment in 1991 raised it to 100%. Typically, the state budget appropriation for the DWM has been between $10 and $11 million. In addition to these costs, the MWRA makes full "payments in lieu of taxes" amounting to over $2 million each year to towns in the watershed area.

Interim corrosion control. Because lead in tap water is a serious public health concern, the Authority is accelerating its efforts to provide water which is less corrosive to the metals present in service lines, plumbing and household fixtures. While a permanent corrosion control treatment system is planned as part of the centralized water treatment plant for Wachusett Reservoir water, it will not be available until 2001. Therefore, an interim corrosion control facility is being constructed in Marlborough, adjacent to the Cosgrove Aqueduct, to ensure safer tap water during the period 1995-2001. The facility, estimated to cost around $8 million, will primarily feed ordinary chemicals such as soda ash and carbon dioxide into the water to reduce acidity, decrease the potential for leaching, and inhibit internal pipe corrosion.

Public education is also an important means of reducing possible intake of lead from tap water. The Authority has worked with public health professionals and government officials to disseminate information on simple precautions consumers can take at home to avoid drinking lead-tainted water. In cooperation with EPA and the Women Infants and Children (WIC) subsidy program, an informational brochure was developed for segments of the population who are most at risk from lead poisoning. The resulting EPA-funded brochure is being distributed through the WIC program.

Quabbin Reservoir treatment planning status. Quabbin Reservoir directly supplies three western-Massachusetts communities via the Chicopee Valley Aqueduct (CVA) and it currently meets the criteria for filtration avoidance. Its water quality is consistently excellent and its watershed is very well protected. If these conditions can be maintained, through continued implementation of watershed protection by the MDC, Quabbin Reservoir can continue to be used by the Authority as an unfiltered supply. Compliance with the SWTR and the Lead and Copper Rule will require construction of new disinfection and corrosion control facilities, and a covered storage facility at Nash Hill Reservoir.

Covered storage program. To preserve water quality after treatment, water suppliers are required to utilize covered distribution storage facilities, rather than open reservoirs which are prone to pollution. These requirements are detailed in state regulations and are reinforced by the SWTR. The Authority's system presently operates five open distribution reservoirs: Norumbega, Weston, Fells, Spot Pond, and Nash Hill. Pursuant to the consent order agreements with DEP, these types of facilities must be taken off-line by 2001. To keep the water distribution system properly functional, new covered storage facilities will have to be constructed at or near these existing reservoirs. To compensate for the loss in operable storage volume, additional covered storage facilities will eventually need to be built at several other locations within the service area. At this time, the proposed design and construction costs total approximately $200 million.

Water supply management and planning

When the MWRA took over the MDC water system in 1985, water demand was consistently 10% greater than the system's safe yield level of 300 mgd. The prevailing momentum in water supply planning had been to search for new sources of water, such as the diversion of the Connecticut River. In 1986 the MWRA Board decided instead to allow the Long Range Water Supply Program three years to demonstrate the effective-

Leak Detection Results 1991-1994

Community	Total Leakage Volume (Thousands of GPD, Estimated)
Arlington	640
Bedford	69
Belmont	43
Boston	12,750
Brookline	460
Cambridge	222
Canton	677
Chelsea	836
Chicopee	722
Clinton	117
Everett	1,058
Framingham	185
Leominster	33
Lexington	434
Lynn	1,135
Malden	740
Marblehead	1,014
Marlborough	568
Medford	2,558
Melrose	435
Milton	816
Nahant	115
Needham	261
Newton	1,395
Northborough	23
Norwood	415
Peabody	137
Quincy	1,193
Revere	477
Saugus	404
Somerville	422
Southborough	108
South Hadley	7
Stonham	348
Swampscott	320
Wakefield	50
Waltham	1264
Watertown	801
Wellesley	101
Weston	65
Wilbraham	4
Winchester	115
Winthrop	354
Woburn	1,770
Total	**35,661**

Table 1.5

ness and validity of various demand management measures. The results of the Authority's demand management program have exceeded all expectations. In 1990, after demand management efforts had begun to pay off, the Board reauthorized the program for five more years, and voted to shelve any supply augmentation plans. As a result of the demand management program, and above average rainfall, the Quabbin Reservoir became 100% full and overflowed in May 1991 for the first time since 1984. Water use for 1993 was the lowest annual average since 1962. Water demand is currently at about 250 mgd, which is 16% below safe yield. The Authority is withdrawing 86 mgd less than it was in 1987.

Because water demand on the Authority's system is now comfortably below safe yield, water supply availability is considered relatively secure. While it appears that this situation will persist for at least the next decade, the Authority must not become complacent or risk squandering the water savings achieved. A commitment to water use efficiency must be maintained, and planning for the future must continue in order to avoid being caught off-guard in case supply or demand circumstances change. The following are components of the demand management strategy.

Leak detection and repair. The Authority aggressively inspects its entire pipeline network for leaks each year, which includes 260 miles of water main. During the past five years, an average of 52 leaks were repaired annually, saving a total of nearly 3 mgd during this period. By tightening up the water delivery system and reducing losses and waste, the Authority has steadily reduced the volume of unaccounted-for water.

Communities served by the MWRA own more than 6300 miles of local pipelines. To encourage appropriate and consistent leakage control within all communities, the Authority promulgated Leak Detection Regulations (360 CMR 12.00) which became effective on July 1, 1991. The regulations require leak surveys at least every two years, and regular reporting to the Authority on leaks detected and repaired. The Authority assists communities through training sessions, equipment loans, technical advice, and contractor arrangements. As shown in Table 1.5 since 1991, communities have detected nearly 2,800 leaks wasting an estimated 35.6 mgd. More than 95% of these leaks have been repaired. The City of Boston, through its Water and Sewer Commission, deserves special praise for its efforts in the area of leak detection and repair. The City started conducting regular leak surveys more than ten years ago, and its ongoing annual program, which saves millions of gallons per day, continues to be a major factor in controlling demand.

Domestic Device Retrofit Program. In October 1990, following a pilot program in a limited number of areas, the MWRA began an innovative, system-wide program to retrofit all MWRA-served households with water-saving showerheads, toilet dams, and low-flow faucet aerators. Called "Operation Watersense," the three-year program was designed to make water usage in area households more efficient, and to inform residents on other useful water conservation techniques. When the program was completed in November 1993, more than 360,000 households had participated in the retrofit program in 42 communities, as shown in Figure 1.10. This represented a successful participation rate of 56%. More than 1.4 million water-saving fixtures were provided through the program, which is estimated to have achieved water savings of more than 5 mgd.

Industrial/Commercial/Institutional water conservation. Non-residential water users account for nearly one-third of water consumption in the service area. The Authority conducts specialized programs to promote water conservation in the industrial,

commercial, and institutional sectors. These programs involve businesses, schools, hospitals, municipalities, and non-profit organizations. Approximately 10 detailed water audits of facilities are conducted each year, pointing out specific opportunities to save water and reduce operating expenses. Information and lessons learned from water audits are generalized and distributed to other similar users through workshops, presentations, and guidebooks, and case studies.

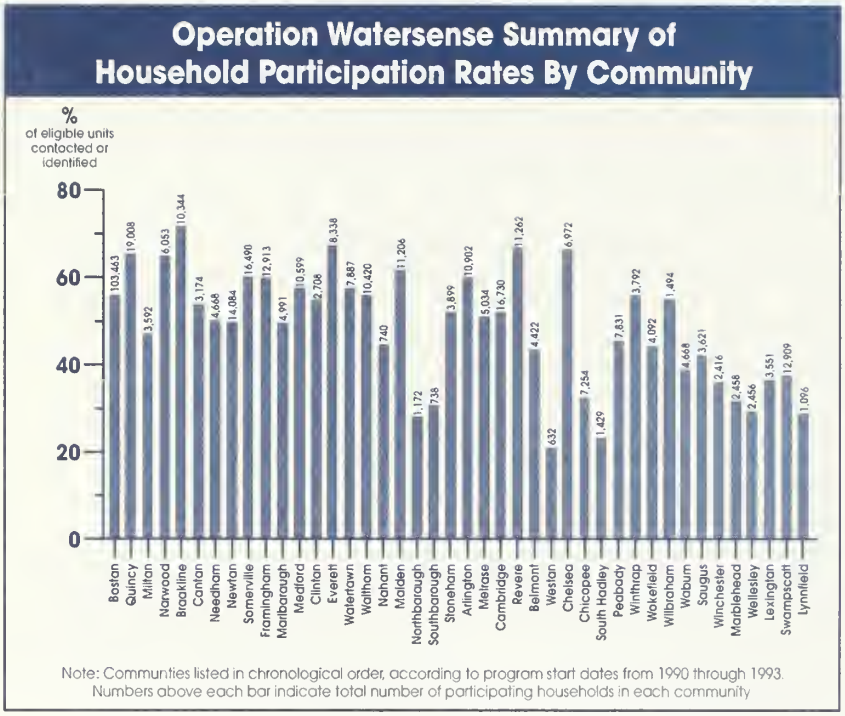


Figure 1.10

For the past two years, water conservation staff have been working cooperatively with the Authority's Toxic Reduction and Control Department and the Massachusetts Office of Technical Assistance to conduct combined water conservation and pollution prevention workshops. The Authority also recently negotiated a contract with Boston Edison Company to conduct joint energy and water audits.

Local source protection and enhancement. Historically, one of the major sources of growth in water demand has been the contamination and abandonment of water supply sources in suburban communities in and near the MWRA service area. In fact, the Waterworks system added a new community customer in 1993, the Town of Bedford, as a result of local source contamination problems within the community dating back to the 1970s. To reduce the demands on MWRA/MDC supplies, diversify the supply base for the Authority, and help delay or avoid the need for costly supply augmentation, the Authority promotes effective protection of existing local supplies and encourages the development of additional local supplies, where feasible, within the MWRA service area.

In 1992 the Authority completed two studies providing baseline information on the risk of local source contamination in the 14 partial user communities and 26 non-MWRA communities on the fringes of the service area. These studies revealed that while most communities are actively engaged in protecting existing supplies, and are committed to providing additional treatment to meet new regulations, significant potential contamination threats exist which should be addressed through additional protection.

The Cambridge Reservoir System has received special attention because it is the largest local source in the area and it faces unique protection challenges. In a separate study conducted by the Metropolitan Area Planning Council (MAPC), the watershed protection needs within the Cambridge Reservoir watershed were investigated. A positive result of this effort was the formation of an Intercommunity Cambridge Reservoir Protection Committee in 1992 to coordinate efforts among the four communities in the watershed.

In the late 1980s, when system water demand was still above safe yield, the Authority initiated a process to investigate the possibility of developing additional local sources of supply. The Local Sources Feasibility Study examined 28 potential sites and narrowed the list to the three most promising development sites. While the Authority encourages communities to consider becoming more self-sufficient through maximum reliance on local sources, the Authority's favorable supply-demand situation at present does not warrant additional efforts to pursue local source development for the MWRA system.

Supply planning for the future. For the next decade, at least, the Authority believes that water demand will remain within the system's safe yield. While thoughts of supply augmentation can be put off for some time, the Authority must still monitor and be ready to respond to circumstances which could alter the balance between supply and demand. These include population changes, business and employment activity, local source availability, drought episodes, reservoir release requirements, and the composition of the service area. The Authority's planning process will include collecting data relevant to these factors for use in forecasting future demand and identifying appropriate actions or policies. The basic strategy will continue emphasizing demand management approaches to keep within the safe yield of existing supplies, while remaining poised to respond to changed conditions or unexpected events.

Rehabilitation and maintenance of the water system

The infrastructure of the waterworks system, which spans across a large part of the state, provides the means to transport water from the supply sources and to deliver it at proper pressure to each community in the service area. It includes 129 miles of tunnels and aqueducts, 265 miles of water mains, 10 active pumping stations, 12 storage reservoirs, 3 active hydroelectric stations, and more than 100 other buildings and structures. This infrastructure represents an invaluable public asset, and the Authority recognizes its important responsibility to protect the value and functionality of this asset through appropriate programs of maintenance, rehabilitation, and improvement.

Much of the system is antiquated; many components were built around the turn of the century, and some elements are nearly 150 years old. The Authority still faces a large backlog of rehabilitation needs due to a long legacy of deferred maintenance and inadequate investment in the system dating back to the 1950s. The Authority has made progress in tackling the most urgent and critical deficiencies, and has prioritized remaining needs for the next 20 years in the Waterworks System Master Plan. One of the Waterworks Division's highest priorities is providing redundancy for the Hultman Aqueduct. Other priorities include rehabilitating the old pipeline network, improving valve operability, upgrading pumping stations, and modernizing meters and facility controls.

New tunnel for the transmission system. The Hultman Aqueduct, built in the 1940s, is the backbone of the transmission system, as it carries 85% of the flow for the metropolitan area. Without the Hultman Aqueduct in operation, the system would not have the ability to deliver high service water to Norumbega Reservoir. This lack of water transmission redundancy means that the Hultman could not be shut down for needed maintenance, and leaves the entire Boston metropolitan area vulnerable to a major water emergency in the event of a Hultman Aqueduct break or failure. The Authority is not aware of any other major metropolitan area in the United States that is so over-reliant on a single water line.

The implications of a Hultman Aqueduct problem would be severe, and as the 50 year old conduit gets older, the risks of such an occurrence increase. Compounding this risk is the fact that routine inspection and maintenance cannot be performed. Five thousand joints connect the sections of the 12-foot diameter steel-reinforced concrete pipe that make up the Hultman. The MWRA has charted 27 locations where leaks at the joints are apparent. Continuing leakage may cause further soil erosion, progressive pipe settling and loss of joint tightness, and finally the possibility of an explosive release of millions of gallons of pressurized water at a displaced joint. Any major break could cause extensive damage to surrounding areas, and would place greater Boston communities in a water crisis that could last for days or possibly weeks. The economic consequences of such an environmental and public health catastrophe could mount into billions of dollars.

The need for redundancy was recognized even at the time of the Hultman Aqueduct's construction. The aqueduct's original design called for installation of a double-barrelled pipeline. However, due to resource limitations during World War II, only one barrel was constructed and the second was deferred. This deferral continued into the 1980s, when the MDC resumed planning for improved aqueduct system reliability. The Authority

continued those studies, which focused on reconstructing the old Sudbury Aqueduct to enable it to operate as a strong back-up for the Hultman.

However, in 1990, upon evaluating the costs and environmental impacts of various alternatives, the Authority found that an all-tunnel approach could be accomplished at a comparable cost and with significantly less land disruption and environmental impact. Therefore, the Authority is pursuing design and construction of the MetroWest Water Supply Tunnel, a 17.5 mile long deep-rock tunnel from Marlboro to Weston. The Authority is expediting the design/EIR process and expects to be in a position to bid the first of five construction contracts in 1995.

The MetroWest Tunnel is envisioned to become the system's primary transmission line when it is completed. Therefore, several other major MWRA projects (some legally mandated for SDWA compliance) are being designed to fit in with the tunnel's planned configuration and operational mode. These projects, such as the construction of covered distribution storage tanks at open reservoirs and a water treatment plant for the Wachusett Reservoir, have been engineered in tandem with the tunnel plan. If for some reason the tunnel is delayed or not built, these other projects will have to be re-designed, causing delay and added expense.

Due to the current and future burden on MWRA ratepayers from federal and state mandated projects, and the importance of a reliable water supply to the economy of the Commonwealth, the MWRA is seeking commitments of state funding assistance for the MetroWest Tunnel, which carries an estimated cost of $435 million (in FY95 dollars).

To control and minimize the consequences of a transmission system interruption, the Authority has prepared an emergency response plan and has conducted a "dry-run" to test staff preparedness. In addition, the Authority has procured several segments of large diameter pipe which could be used to help expedite repairs to the Hultman Aqueduct in case of a minor break.

Pipeline renewal. The distribution system has 265 miles of pipeline which distribute water to 47 communities. More than half of these pipelines are over 80 years old. Three-quarters of the pipelines have bare metal interior linings which are especially prone to corrosion and rust build-up. These poor internal conditions reduce carrying capacity and present water quality risks. At regular intervals along each pipeline are various types of valves necessary for system adjustment, maintenance activities, and emergency repair operations. In all, the pipeline network has more than 3,000 valves, and unfortunately, most of these valves are excessively old and unreliable.

In the Authority's early years, pipeline projects focused on replacing some of the system's worst pipe segments and completing construction of several new pipelines needed for adequate service. But this work represents just the beginning of a long-term, ongoing pipeline rehabilitation program. Because the pipeline network was neglected for so long, the Authority estimates that nearly 200 miles of pipe require rehabilitation or replacement. To meet this need within a reasonable time span, the Authority aims to renew approximately five miles of pipe each year for the next 30 years, at an annual cost of around $20 million. The Authority has taken the following steps toward undertaking this massive pipeline renewal program:

- Completed in 1990 the Water Distribution System Model Study which evaluated the hydraulic performance of the system, recommended improvements to ensure adequate service, and equipped the Authority with a state-of-the-art computer model for pinpointing deficiencies and predicting system performance under different conditions.

- Completed in 1991 the Corrosion Study which identified the pipes that had the most serious corrosion problems.

- Developed in 1993 the Waterworks System Twenty Year Master Plan which integrated information from prior studies to establish priorities and a scheduling sequence for pipeline projects for the next 20 years.

- Began design of six pipeline rehabilitation projects, using in-house staff for smaller-scale projects, and consulting engineers for larger, more complicated projects.

- Initiated production of updated, detailed maps of the distribution system using the Authority's extensive Geographic Information System (GIS).

- Established inter-departmental teams to coordinate design needs and decisions, to plan for field investigations, to establish project schedules and priorities, and to develop standardized design procedures and specifications.

Valve improvement. An aggressive valve improvement program is underway to ensure the operability of main-line valves, and to upgrade blow-off and air-release valves to meet current standards. Prior to this program, most valves hadn't been inspected or operated for decades, and thus their condition was unknown. Now the Authority regularly inspects all valves and attempts to operate main-line valves which were previously considered to be frozen shut or otherwise inoperable.

Through this preventive maintenance program, the Authority has made many valves operable, saving on capital replacement costs. During the last five years the percentage of operable valves has increased from 30% to 76%. MWRA staff have inspected an average of 750 main-line valves and 700 air-release valves per year. A total of 53 main-line valves and 505 air-release valves were replaced during the period. A separate capital project has been initiated to upgrade about 20 blow-off valves each year.

Pumping station rehabilitation. Approximately 20% of the water delivered by the metropolitan system requires pumping to serve areas of higher elevation. Ten active pumping stations, ranging in age from 35 to 95 years, provide this capacity. Many of these stations operate with outdated, undersized equipment, are housed in sub-standard buildings, and must be monitored or controlled with on-site staffing.

Four stations are in the process of being rehabilitated (Spot Pond, Commonwealth Avenue, Newton Street, Lexington Street). Initial electrical and safety improvements have been implemented, and designs for renovation, modernization, and expansion have been completed. When construction work on these stations is completed within three years, rehabilitation of the remaining pumping stations will commence.

Metering and monitoring improvements. The MWRA's water meter system is designed to provide on-line, real-time information on meter flows and pressures at key points within the delivery system and at each point of distribution to customer communities. This allows for accurate rate charges and assists in controlling unaccounted-for water and monitoring system conditions. The Authority is in the process of putting in place a modern, computer-based system to continually monitor most facilities for immediate indication of problems and emergencies. Improvements completed within the past five years include:

- Replacement of community revenue meters at 64 sites, essentially completing the standardization of all revenue meters based on a venturi-type design with safe, secure, and accessible chambers, and modern instrumentation. This project, brought on-line in 1994, eliminated most mechanical meters from the system and eliminated the practice of manual meter-reading . Site improvements at another 60 locations will be implemented over time in conjunction with pipeline projects.

- Installation of telog data loggers at most meter locations, allowing improved access to critical data such as meter flows, pressures, and storage tank elevations.

- Construction of the Operations Center at Chestnut Hill to serve as the central location for system monitoring and control, completed in the summer of 1994.

- Establishment of the important groundwork for the future Central Monitoring System. The communications network, using licensed radio frequencies and microwave equipment, was brought on-line beginning in 1993. Staff have completed the links connecting MWRA facilities to the state's Interagency Microwave System.

Planning is underway to enable Authority operators to control key facilities from the Operations Center.

- Pump station monitoring devices have been upgraded with electronic displays and chart recorders. Modern level monitoring devices were installed in all water tanks replacing manual and mechanical devices.

Facility improvements. A new, more secure transmission maintenance headquarters building was completed in 1993 adjacent to the Southborough Water Quality Laboratory to replace an old, inadequate facility near Lake Cochituate. The new facility includes carpentry, masonry, plumbing, painting, electrical and machine shops; storage space for equipment and supplies; and office space for administrative staff. The facility houses approximately 65 people from the administration, aqueduct and plant maintenance staff.

Chlorination facilities at both Weston Reservoir and Norumbega Reservoir were upgraded to replace obsolete equipment and to provide safer conditions for handling and storing treatment chemicals. Norumbega improvements were completed in 1989, and Weston improvements in 1993.

Planning has been conducted to centralize other waterworks maintenance facilities and workshops in the metropolitan area. Many of these facilities, such as Glenwood Yard and Mystic Shops, are overcrowded and inadequate for current operations. The North Maintenance Facilities project will address these needs through the construction of a new building to house staff, equipment, and supplies presently located at various sites.

The Authority is planning to conduct a detailed assessment of its 140 other waterworks buildings to determine repair and renovation requirements. This facilities management study will enable the Authority to assign appropriate resources necessary to ensure acceptable working conditions and to curb continued structural deterioration.

Fore River Staging Area

In November 1987, the MWRA purchased from General Dynamics the former Fore River shipyard site in Quincy and Braintree. Parts of the 186 acre site, renamed the Fore River Staging Area (FRSA), have been developed for a number of uses, including the sludge-to-fertilizer plant and construction laydown and storage for the Boston Harbor Project. Approximately 24 acres have also been leased to the United States Naval Shipbuilding Museum. Although the fertilizer plant, various other MWRA uses and the Naval Shipbuilding Museum will remain when construction of the new secondary treatment plant on Deer Island is completed in 1999, much of the site will be open to new development.

Redevelopment Task Force. A Redevelopment Task Force has been working since 1991 to determine acceptable long-term reuse plans for the Fore River Staging Area. In 1993, the group, which includes representatives from the MWRA, the state's Coastal Zone Management (CZM) agency and the communities of Braintree, Weymouth and Quincy, enlisted the aid of a consultant team led by Lane, Frenchman & Associates, Inc. (LFA) of Boston, to develop reuse options for the former shipyard. Funding for this consultant was provided by Quincy (11%), Braintree (12%), the MWRA (43%) and a grant from the Executive Office of Community Development (34%). The group's goal is to develop a reuse option that will benefit the local economy and neighboring communities and bring an acceptable return on ratepayers' investment in the shipyard purchase.

Redevelopment plan. The consultant team finished a plan in July 1994 after a fourteen month process which included meetings with many community leaders and elected officials as well as the larger local neighborhood. The process produced goals and principles for the site development as well as a final set of mixed uses that are acceptable and feasible based on the consultant team analysis. The plan provides a set of uses including maritime industry, a marine technology center and education/tourism as the key components. MWRA staff and community leaders have worked closely with

Congressman Gerry Studds' office and the Executive Office of Economic Affairs regarding negotiations for a long term lease of a portion of the shipyard for shipbuilding, in coordination with the legislation filed by the Congressman. In October 1994 a detailed term sheet was signed between the MWRA and Northeast Shipbuilders Inc. (NSI), the potential shipbuiding tenant. NSI is currently working to complete applications to the U.S. Maritime Administration in Washington, DC for $230 million in federal loan guarantees for site improvements and ship construction. Previous attempts at revitalizing the yard through the efforts of smaller companies had ended in failure twice since 1991.

"**Catalyst Uses**". The Redevelopment Task Force and CZM also funded an amendment for LFA to continue to work to develop "catalyst uses," the pieces of the plan seen as the critical beginning links to successful redevelopment which would spark additional interest in the site. The first of these was a proposal for National Park Service (NPS) involvement in the site. MWRA staff and the consultants began to have discussions with the NPS about their possible plans for the area and the natural link with this historical waterfront site. The NPS has since drafted a plan for the establishment of the Boston Harbor Islands as a National Recreation Area and has designated FRSA as a ferry site with a small NPS presence on the site. The second catalyst use is the Maritime Technology Center concept, the development of which may be possible through funding being made available from the federal government through the Advanced Research Projects Agency. The Center is envisioned as a Marine Engineering and Industry Center, with a coalition of educational institutions, private firms and public partners. Several small firms, the Marine Technology Society, MIT naval research, Massachusetts Maritime Academy and the Woods Hole Oceanographic Institute have shown an interest and efforts to develop such a center are ongoing.

Keeping Rates Affordable

For the 20 years before the legislature created the MWRA, the MDC spent an average of only $11 million a year on capital investment in the basic water and wastewater infrastructure for the communities it served. By contrast, from fiscal years 1986 to 1994, the Authority spent over $1.8 billion on rebuilding its service delivery system. Rates that were among the nation's lowest in 1986 have significantly increased to support this effort. From FY85 to FY95, the Authority increased total sewer charges by 867.5% and total water charges by 200.4% for a combined increase of 561.7%.

In 1992, following several years of double-digit rate increases, the ability of many service area residents to pay their water and sewer bills was seriously questioned. Recognizing rate affordability as its most pressing priority, the MWRA Board of Directors and Advisory Board launched an intensified effort to work with the state's Congressional delegation and with state lawmakers to pass rate relief legislation. The MWRA was a founding member of two organizations, the Massachusetts Clean Water Council and the National Water Funding Council, which brought together other communities in the Commonwealth and the nation faced with sizeable water and sewer projects, along with members of the engineering and legal community and large customers, to lobby for rate relief and regulatory reform.

With the support of lawmakers, the public, the business community, environmental organizations and other constituent groups, the MWRA developed and implemented a rate relief strategy to keep capital and operating costs to a minimum and increase federal and state funding. Thanks to these efforts, in FY94 the Authority was able to significantly reduce the increase in rates and charges over previous projections, and in FY95 the Authority did not increase its aggregate rates and charges at all.

Controlling MWRA costs

Underlying all of the Authority's system improvement and environmental and public health protection efforts is the ultimate goal of ensuring that they are cost-effective and affordable to ratepayers.

In 1992 an Ad Hoc Budget Review Committee composed of Advisory Board and MWRA Board members was created to improve the MWRA budget process, and to foster more accountability to ratepayers. Recommendations included more formal consultation with the Advisory Board early in the budget process, and a tiered approach to budget review to focus attention on the most significant financial and policy issues in the proposed budgets.

At the beginning of every budget cycle, members of the Authority's finance staff work closely with the staff of the Advisory Board to evaluate ways to limit spending. Meanwhile the Authority's own budget preparation is driven by rate targets directly tied to the maintenance of its service mission in the context of bringing on line its new facilities. With the Advisory Board's encouragement, the Authority is focusing new levels of attention on performance standards and output measurements as ways to tighten spending requirements and improve efficient delivery of services. This is reflected in a budgeting system that includes performance targets and a regular reporting structure, and in a performance appraisal system for senior managers that incorporates these same measures.

Management and financial controls. The Authority has developed an extensive set of internal controls to assure the sound fiscal management of the organization. These controls are documented and communicated in a set of policies and procedures established by the Board of Directors for performing its major business functions including accounting, auditing, budgeting, hiring and procurement.

The Authority continues to identify ways to further strengthen its internal controls. For example, since March 1993, accounts payable, some materials management, contracts and payroll functions have been brought in-house and are now performed through an integrated management information system.

State management review. In May 1994, KPMG Peat Marwick completed a study commissioned by the Commonwealth of Massachusetts in which it conducted a management review of the Boston Harbor Project, as well as of other areas of MWRA management. The consulting team, comprised of nationally recognized experts, determined that the Authority "has demonstrated effective overall management" and that project management reporting is "thorough and exhaustive." In the report, Peat Marwick stated that "despite the complexity of wastewater facility construction, the challenge of constructing this [Deer Island] facility on a very small island and isolated peninsula, sometimes extreme weather conditions, continual reviews of the MWRA by other parties, and the aggressive Court imposed time schedule (milestones), the project is under budget and generally close to schedule."

Furthermore, the report stated, "it is the opinion of the team that the project management structure is functioning to achieve overall cost effective results." The state's report recommended opportunities for up to $300 million in capital construction savings, many of which are addressed below, and made other specific management suggestions which have been incorporated into the MWRA's operations.

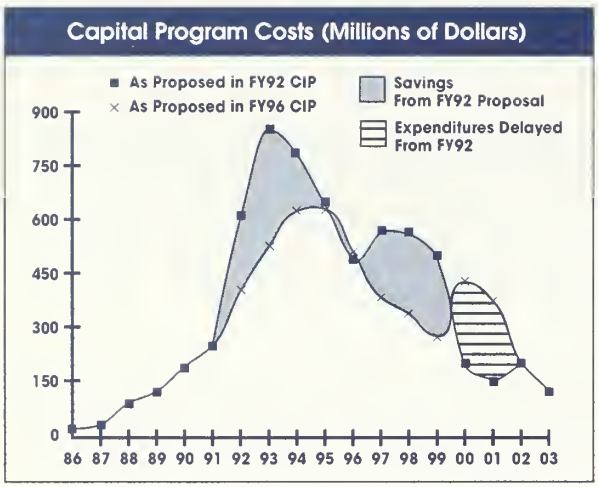


Figure 2.1

Cost-effective capital facilities. The Authority is pursuing opportunities for reshaping its capital program so as to meet the wastewater and drinking water quality requirements through the most cost-effective available means. Capital spending since 1990 has been almost entirely devoted to the Boston Harbor Project and system rehabilitation projects (for a summary of the Authority's capital investments, please see Appendix 4). Spending will peak in the current year at over $600 million, but will continue at an annual average rate of nearly $400 million over the next five years. The focus will shift, however, since nearly one-third of total spending in the next five years will be to support Safe Drinking Water Act (SDWA) compliance and aqueduct improvements.

Figure 2.1 compares the magnitude of the capital program as it was projected in FY92 against current projections. The very significant decrease in total capital costs reflects lower than expected construction costs, and the results of the reevaluation of the scope of both the Deer Island treatment plant and the long term CSO plan. These initiatives, plus possible savings in water treatment costs, could save the Authority more than $1.5 billion in capital construction costs.

Deer Island design reassessment—In 1993 the Authority began a study to assess the scale of the Deer Island treatment plant based on new information, regulatory requirements and innovative treatment technologies. The draft report recommends that the MWRA reduce the size of its planned secondary treatment facilities without sacrificing environmental quality. If federal court approval is received, the MWRA would eliminate the construction of the planned fourth battery of secondary treatment and additional residuals facilities on Deer Island, while still meeting all secondary treatment and water quality requirements. The reduction in size is made possible because the projected level of wastewater flows to the new treatment plant is less than that estimated by the Authority during its facilities planning process in 1988. This is due to both the Authority's new capability to measure rather than estimate flows and an aggressive sewer improvement program. A draft report was released in November 1994 for public review and comment, and the MWRA Board of Directors is expected to vote on the recommendations in January 1995. A schematic diagram of the recommended plan is included as Appendix 4.

Projected savings: $165 million in capital construction costs.

Reevaluation of the long term CSO plan—In 1990 the MWRA completed a CSO Facilities Plan that proposed a regional tunnel storage system at an estimated cost of $1.3 billion. Following the receipt of new information on flow predictions, the release of national guidelines for CSO control, and the development of a master plan to integrate all components of the wastewater system, MWRA has determined that CSOs can be more cost-effectively handled on a site-by-site basis rather than through a single system-wide approach. The MWRA expects that a new conceptual CSO control plan will be proposed to the federal court in 1995.

Projected savings: $900 million in capital construction costs.

Dual-track SDWA compliance approach—With the help of the Water Supply Citizens Advisory Committee and the Advisory Board, the Authority is pursuing an innovative "dual-track" approach to complying with the Surface Water Treatment Rule of the federal Safe Drinking Water Act. By working with the MDC to improve watershed management for the Wachusett Reservoir, the Authority may be able to limit the scale of the new plant to avoid expensive elements of water filtration.

Possible savings: $200 million in capital construction costs.

Cost control and management initiatives—The MWRA Board of Directors has established as a priority the pursuit of cost control objectives on a continuous basis to assure that staff in all parts of the organization appreciate the on-going responsibility for cost-effective management. Cost control initiatives include:

- Since April of 1992, the Authority has reduced its cost projections for operating the new Deer Island Treatment Plant by about $5 million/year for FY95 through FY2000. The Sewerage Division continually reviews all new positions prior to posting and proceeding with recruitment, and staff continually review and refine estimates for all operating costs.

- Through management initiatives including the increased use of methane gas produced by the sewage treatment process, the Sewerage Division avoided the purchase of fuel oil and thereby reduced fuel costs as compared to FY92, by about $830,000 in FY93 and about $1,300,000 in FY94.

- In 1993 the Authority reassessed the assignment of vehicles for MWRA domicile (overnight home) travel, resulting in a 40% reduction in domicile vehicles by December 1993.

- The Authority also reviewed the assignment of cellular telephones, resulting in a 50% reduction in cellular telephone assignments between June and December 1993.

- The Authority's Internal Audit Unit agressively audits the "overhead" allocations charged to the Authority under the fee provisions of its engineering and other consultant service agreements. Since 1987 these audits have recovered $6 million. Other management and financial audits have produced significant on-going cost savings.

- Authority staff have implemented cost-avoidance and cost-savings initiatives for a range of activities including postal and delivery services; copier trade-ins and maintenance; recycling; and use of in-house staff for training, telephone moves and changes and office relocations.

"Common Goals" initiative. In 1994 the MWRA and the Advisory Board began a "Common Goals" initiative to improve the working relationships between the Authority and its customer communities. As part of this initiative, standard guidelines for engineering and construction practices were developed to address the impacts of MWRA construction projects on particular communities. These guidelines will be of great assistance as the Authority continues with its capital construction program in the future. The spirit of the initiative will also provide important guidance during upcoming mitigation discussions with communities which host MWRA facilities.

State debt service assistance

As a result of the Authority's and others' efforts, and particularly in response to the public opposition to rate increases demonstrated in the spring of 1993, the Commonwealth in its FY94 budget act established a Commonwealth Sewer Rate Relief Fund, to which $30 million was appropriated for FY94 and $49 million for FY95. The purpose of the fund is to make state debt service assistance available to issuers of indebtedness, such as the Authority, for qualified wastewater projects in order to mitigate extraordinary increases in ratepayers' sewer costs. The MWRA received $19 million in state assistance in FY94 and $27 million in FY95 (see Table 2.2). Since debt service on bonds sold to finance the MWRA's capital program is the single biggest factor driving up sewer rates, this infusion of direct assistance provided immediate and significant relief to MWRA ratepayers.

Boston Harbor Project Costs and Funding: $3.5 Billion

Funding sources ($ in millions)	Applied before 6/30/94	Applied after 7/1/94	Total	Percentage
Federal grants and federal SRF*	$ 246	$ 386	$ 632	18%
State grants and state SRF	122	29	151	4%
Ratepayer supported MWRA bonds**	1,607	1,087	2,694	78%
Total	1,975	1,502	3,477	100%

* All SRF amounts have been converted to "grant equivalency" basis

** Ratepayers' burden of paying debt service on MWRA bonds has been assisted by $19 million state debt service assistance for FY94, $27 million for FY95.

Table 2.2

Low income ratepayers. The impact of water and sewer rates on low-income customers poses a difficult challenge for water and sewer utilities nationwide. In December 1991, the National Consumer Law Center (NCLC) released a report entitled *The Impact of Rising Water and Sewer Rates on the Poor,* which noted that "over 100,000 households in cities and towns receiving sewer and water service from the Authority have incomes that are too low to afford the basic necessities of life." Community discount programs for the elderly and other retail customers have often not been enough to address the needs of low-income ratepayers. To help its customer communities address this retail rate issue, the Authority has worked closely with NCLC and others to gather information on programs used elsewhere and to develop appropriate responses. To this end, the Authority has supported legislation that would provide state-funded assistance to low-income homeowners through a program based on the same principle as the low-income heat assistance program.

Federal funding

Thanks in large measure to the focused efforts of the state's Congressional delegation, MWRA ratepayers have received the benefits of a significant amount of federal grant assistance for the Deer Island treatment plant in an era of cutbacks in earmarked funds for such projects. A total of $530 million in special grant funding has been appropriated to date by Congress for the Boston Harbor Project. Approximately $80 million was made available through FY91 as the result of the Clean Water Act amendments of 1987. In addition, $100 million was provided each year in the FY92 and FY93 federal appropriations bills. In October 1994, President Bill Clinton signed into law an appropriation for $250 million in funds for the Boston Harbor Project (see Table 2.2).

State Revolving Fund program

The State Revolving Fund (SRF) Program provides state and federal support to reduce interest costs on funds borrowed to finance certain sewer related capital projects. Basic funding comes from the federal government under the provisions of the Clean Water Act of 1986. The Commonwealth is required to provide at least a 20% match for the federal funds. To date, the Authority had borrowed $236 million under this program and expects to borrow an additional $75 million in the spring of 1995. The interest

subsidy on the SRF borrowing to date has a "grant equivalency" value of $127 million. Just over 60% of this grant equivalency value is from the Commonwealth. Continuation of this program depends upon federal reauthorization of the Clean Water Act. Congress is also considering various proposals to establish a similar program to offset the cost of water projects in conjunction with the reauthorization of the Safe Drinking Water Act.

Ratepayer financing

More than 80% of the Authority's revenues historically have been derived from the rates and charges paid by the customer communities for wholesale water and sewer services. Water charges are generally based on water consumption in the preceding calendar year, with the exception of 19 communities which have other contractual arrangements. Sewer charges currently are computed on a proportional allocation basis utilizing population and other factors. A new sewer rate methodology, based partly on wastewater flow, will be phased in beginning in FY96.

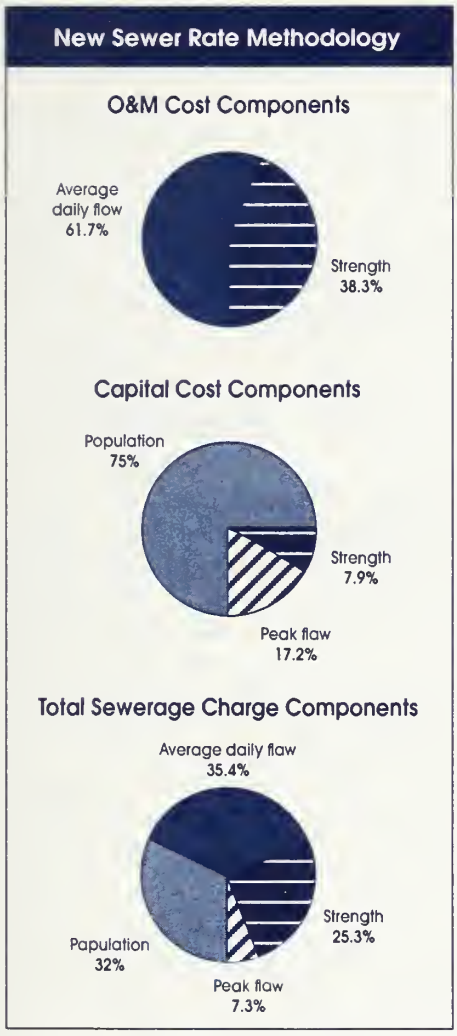


Figure 2.2

Six communities, of which the Boston Water and Sewer Commission is the largest, account for over 50% of the Authority's aggregate rates and charges. For each complete fiscal year since its inception, the Authority has collected 100% of its rates and charges within the fiscal year in which they were billed. In seven cases, the MWRA used the local aid intercept mechanism established by its enabling legislation in order to collect charges to a community. As a wholesale supplier of water and sewer service, the MWRA bills each of the municipalities that it serves for water and/or sewer charges and it is then the responsibility of the municipalities to assess the homeowners and businesses. Legislation enacted as part of the Commonwealth's FY94 budget act gives cities and towns the option to transfer the debt service portion of sewer bills onto the property tax base, over and above the revenue-raising limitation of Proposition 2$^1/_2$. This will give homeowners an additional Federal income tax deduction.

Sewer rate methodology. In 1993 the Authority's sewer rate methodology became the focus of considerable controversy, including a lawsuit filed in Massachusetts Superior Court by the City of Quincy, and later joined by the Boston Water and Sewer Commission challenging the methodology. On August 10, 1994 the Court upheld the lawfulness of the Authority's methodology in a decision which the plaintiffs have appealed.

Despite court approval of the methodology, efforts to modernize and improve the methodology (last revised in 1980) have received widespread and sustained attention. In response to the increasing impact of MWRA rates on local communities, and with the advent of never-before-available sewer meter data, the legislature directed the Advisory Board in June 1993 to conduct the necessary studies to develop a sewer rate methodology which fairly and equitably assesses the communities for sewer services, giving consideration to volume of flow, impact of wet weather flows to encourage infiltration and inflow reduction, strength of flow and other relevant factors. To assist the Advisory Board in designing the methodology, the Authority contracted with Ernst & Young, in association with Metcalf & Eddy, to prepare a sewer rate methodology data collection study. In addition, the Advisory Board retained Coopers & Lybrand to assist its Sewer Rate Methodology Committee in evaluating different methods of allocating Authority sewer costs.

In June 1994, the Advisory Board voted to adopt a sewer rate methodology which allocates operating costs based upon total metered flow (with adjustments for strength of flow) and allocates capital costs based upon a combination of total metered flow (with adjustments for strength of flow) (2/8), contributing population (3/8), and census population (3/8) (see Figure 2.2). The Advisory Board filed its report with the legislature recommending the new methodology in June 1994, together with a recommendation

that the Authority develop an implementation plan for the new methodology. In November 1994, the Advisory Board approved an implementation plan. The new methodology and implementation plan, assuming approval is received from EPA, will be incorporated into the MWRA's FY96 proposed Current Expense Budget and calculation of rates and charges.

This change will introduce a measure of potential variability and unpredictability in year-to-year community charges unprecedented in the Authority's ten year history or in the prior history of MDC assessments. Although community sewer charges have increased significantly since FY86, under the old methodology each community's charge as a portion of the system has remained relatively consistent. Under the new flow-based methodology, year-to-year community charges as a portion of the system are likely to fluctuate significantly mainly because metered wastewater flow has several sources. In fact, infiltration and inflow can account for as much as 70% of a community's flows. Rainfall and other weather factors can therefore lead to dramatic changes in flows, even though populations remain constant.

Bond program. The MWRA has financed the bulk of its capital program through the issuance of tax-exempt bonds. The Authority currently has accumulated nearly $2.7 billion in outstanding debt by issuing bonds to various institutional and individual lenders, and will spend another $3 billion (in FY95 dollars) between FY96 and FY04 to be financed principally from issuance of additional bond sales. As a result, debt service represents the single biggest item in the annual current expense budget.

In this context, minimizing the interest paid on borrowed funds is critical to reducing long-term costs to ratepayers. As shown in Figure 2.3, on November 15, 1993, the MWRA took advantage of generally low interest rates and sold $449 million in revenue bonds at an interest rate of 5.66%. This financing is expected to save ratepayers $2 million per year over the 30-year life of the issue when compared to previous projections.

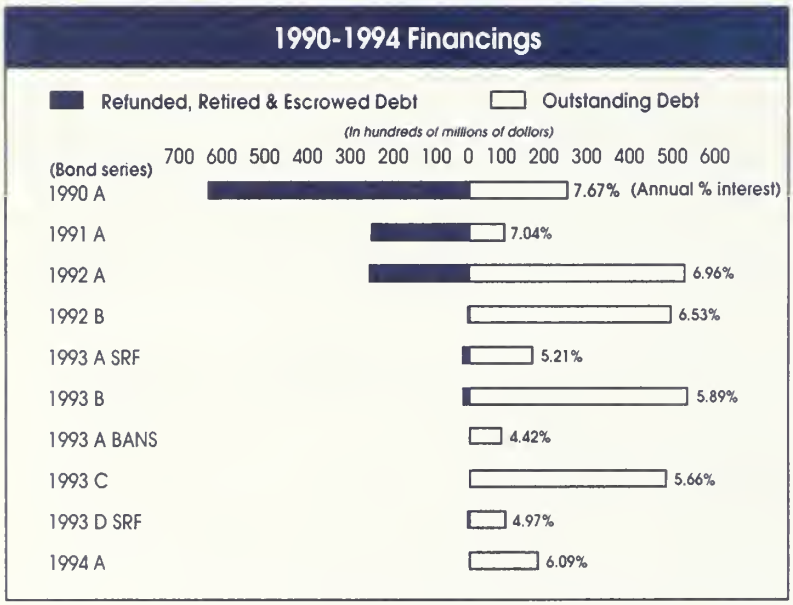


Figure 2.3

Between 1990 and 1994, the Authority borrowed capital funds through large, fixed rate bond issues. Now, the MWRA plans to diversify its debt portfolio as a reflection of both the size of its outstanding debt and its ability to attract investors, and manage a more complex debt structure. This diversification will include use of tax-exempt commercial paper and consideration of variable rate bonds in selected cases. Adding a limited amount of short term debt typically lowers interest costs and thus reduces rate requirements on customers.

In 1990 the Authority received an "A" rating from Moody's Investors Service and an "A-" from Standard and Poors Rating Group. It has been rated "A" by Fitch Investors Service since 1991. In November 1993, Standard & Poors upgraded the MWRA's bond rating to an "A." The rationale for the upgrade included completion of substantial design and construction work on the Boston Harbor Project, continued progress in awarding contracts at lower than conservatively assumed estimates "due to strong management and very fortuitous inflation and interest rates environments", lower-than-expected retail rate needs, legislative action to provide state debt service assistance, the successful resolution of controversial issues such as the Walpole landfill and outfall siting controversies, and the improved credit rating of the Boston Water and Sewer Commission. This upgrade may save the Authority an estimated $100,000 annually for each $100 million borrowed subsequently.

Maintaining Public Confidence

The Authority constantly strives to maintain strong relationships with the various constituencies it serves, including its customer communities, the Advisory Board, elected and appointed officials, neighborhoods hosting its facilities, interest groups, and the public at-large. Public outreach and education, critical to building support for the Authority's operational and environmental objectives, are accomplished through a wide variety of activities. These efforts include school education programs, technical assistance to industrial customers, rapid response to public and media inquiries, facility tours, informational publications, intergovernmental liaisons, and targeted programs for communities impacted by Authority facilities.

Over the last five years, the MWRA has continually strengthened its public participation and education programs, both through the activities of its professional public affairs staff and by opening up its operations and decision-making processes to the maximum extent possible. A major reorganization of the Public Affairs Department took place in 1993 to maximize the use of in-house communications, community relations and government affairs staff to better serve MWRA customers and comply with legal public participation and notification requirements. In September 1993, the Authority was honored with the New England Water Works Association's "Distinguished Public Involvement Award" for the outstanding public affairs program among the region's water suppliers.

Community relations

The MWRA's commitment to effective communication runs from day-to-day responsibilities such as notifying customers of service interruptions due to MWRA maintenance and construction work, to comprehensive public participation programs for major capital projects implemented under the auspices of the Massachusetts Environmental Policy Act (MEPA). Many of the Authority's operational and policy decisions are made with advice and support from the Advisory Board's membership and full-time professional staff. In addition, the MWRA funds professional staff for two standing advisory committees appointed by the Board of Directors.

Wastewater Advisory Committee (WAC). Established in 1990, WAC offers independent advice to the Board and staff on wastewater policies. WAC is the successor to the Facilities Planning Citizens Advisory Committee, which was established as part of the extensive public participation process that accompanied the siting and planning of the new facilities on Deer Island.

Water Supply Citizens' Advisory Committee (WSCAC). A key player in the Authority's deliberations on drinking water policy since the MDC began its Long Range Water Supply planning process in 1977, WSCAC's relentless lobbying efforts supported the MWRA Board's decision to shelve a longstanding plan to divert the Connecticut River to augment the supply of water in the Quabbin Reservoir. Instead, the Authority adopted a demand management program and has worked to preserve local sources and watershed areas to maintain or improve water quality. WSCAC was also instrumental in the development of the "dual track" Consent Agreement between the MWRA, MDC and DEP to bring the water system into compliance with the Surface Water Treatment Rule of the federal Safe Drinking Water Act.

The Authority also supports advisory committees, working groups and project-specific task forces, as well as technical consultants to communities most heavily impacted by construction activities. For example, the Nut Island Citizens Advisory Committee, inherited from the MDC, meets regularly with MWRA staff to address the impacts of Nut Island treatment plant operations and headworks construction on the Hough's

Neck neighborhood which abuts the site. Advisory committees active during the past five years are included in Table 3.1.

Memoranda of Understanding govern the MWRA's relationship with, and funding provided to, the towns of Winthrop and Braintree, the City of Quincy and others. MWRA project staff are in frequent contact with local officials and consultants to these communities to keep them informed of any developments which could impact their constituents.

Local Advisory Committees Active Within the Past Five Years

Charlestown Neighborhood Council
CSO Neighborhood Working Groups
Commonwealth Ave Working Group
Fells Reservoir Working Group
Fore River Citizens Advisory Committee
Fore River Public Involvement Plan
Framingham Working Group
Friends of Waterworks, Inc.
Healthy Charlestown Coalition
Leach Lane Working Group
Norumbega Working Group
Nut Island Citizens Advisory Committee
Turtle Lane Working Group
Weston Working Group

Table 3.1

Communications

In addition to fielding hundreds of media requests annually and issuing news releases about MWRA projects and issues, the Authority supports its communication efforts through reports, newsletters, fact sheets, slide shows and videos. Table 3.2 lists the major publications produced by the Authority over the last five years. Most of these materials are prepared and produced by the Authority's own staff. The efforts of in-house staff on Boston Harbor Project communications and documentation needs are augmented by communications consultants directed by the project.

One of the most effective means the Authority has to demonstrate how ratepayers' funds are being invested is through facility tours. Over the past five years, as construc-

MWRA Print Materials

Internal Publications
This Week Newsletter
Code of Conduct Brochure
SuperNews Newsletter

General External Publications
MWRA Annual Report
Annual *State of the Harbor* Report
Your Water System Is Working brochure
Your Sewer System Is Working brochure
The Boston Harbor Project Is Working brochure
MetroWest Water Supply Tunnel Info Kit
The Residuals Plan Fact Sheets
The Boston Harbor Project Fact Sheets (Series of 8)
Southern Collection System Pamphlet
Just the Facts Pamphlet
Healthy Environment Starts At Home HHW Guide
CSO Community Bulletin
Wellesley Interceptor Community Bulletin
Water Resources Newsletter
Staging Area Newsletter
Nut Island Network Newsletter
Hardhat News Newsletter
Harbor Prospects Newsletter
Winthrop Bulletin Newsletter
Turning the Tide Pamphlet
Inside Scoop Residuals Newsletter
Operation WaterSense Pamphlet
Mass Water Investor Relations Newsletter
Affirmative Action Pamphlet
Minority and Women Business Pamphlet
Procurement Booklet
Rate Relief Newsletter

Residential and Commercial Water Conservation Materials
Home Water Conservation Guide
Renters Pamphlet
"Every Drop Counts" Bill Insert
"Appreciate Our Liquid Assets" Bill Insert
"Garden and Landscaping Water Conservation Tips"
Water Conservation Strategies for Industry Brochure
Industry - Specific Conservation Bulletins

School Program Materials
Water Wizards Elementary Curriculum
Water Watchers Junior High Curriculum
Water Wisdom High School Curriculum
Down the Drain Junior High/HS Curriculum
School Program Pamphlet
Water Matters Teacher Newsletter
Boston Harbor Educators Conference Materials

Table 3.2

tion on Deer Island has reached its peak, over 20,000 visitors from across the United States and from dozens of countries around the world have toured the construction of the new plant and the sludge-to-fertilizer plant at Fore River. In addition, videotaped tours and construction updates are regularly produced and broadcast on cable television outlets throughout the MWRA's service area.

In 1993, the MWRA designed and produced a display for the lobby of the Conservation Law Foundation at a highly visible location in downtown Boston. In the same year, the MWRA also worked with the New England Aquarium to update its "Boston Harbor Room" educational exhibit. In October 1994, the MWRA supported and participated in the Harbor Visions Charrette and Youth Charrette. The Charrette, co-sponsored by Save the Harbor/Save the Bay, the Boston Society of Architects and U.Mass./Boston's Urban Harbors Institute, brought over 300 people together in the interest in planning the future of Boston Harbor. In 1992, the Authority used the enormous attention focused on Boston Harbor at the time of the Tall Ships event to invite community officials, legislators and ratepayers on an educational tour of the harbor including the Deer Island construction site.

School education program

The Authority regularly communicates with students, parents and teachers through its award-winning water and wastewater school education program. This small but effective program serves to support the Authority's water conservation efforts, educate ratepayers as to the most effective use of the water and wastewater systems, and to build public understanding of the need for proper maintenance and operation of the water and wastewater systems. With the help of classroom teachers, the Authority has developed written curriculum guides containing hands-on activities for a range of topics and grade levels. In addition to the curricula, the school education program also offers classroom presentations and tours of Authority facilities.

Over the past five years, school program staff made more than 2,500 classroom visits involving over 80,000 students. The program has been used in every MWRA community in the past five years. The Authority has entered into formal partnerships with two schools, in Framingham and Quincy, and each year sees every student at Parlin Junior High School in Everett for both water conservation and wastewater sessions.

School education staff serve on a number of environmental education committees and are instrumental in sponsoring the annual Massachusetts Bays/Boston Harbor Educators Conference. They are also responsible for an annual poster and essay contest. Between 1990 and 1994, more than 20,000 entries were submitted to the contest.

In 1993, the Authority's school program was expanded to include a field water quality testing program for both fresh and salt water. The water quality testing program provides a unique opportunity to link education with real world issues. By encouraging the integration of ecological, economic, social and political disciplines, it helps students and teachers develop the knowledge and skills essential to the resolution of critical water quality issues facing the MWRA service area.

"Enviro-lab", a research boat operated by U. Mass./Boston, takes students onto the harbor where they can see first hand the water quality improvements and healthy marine life. To make this opportunity more available, the MWRA offers 50/50 matching grants to schools within its sewer service area. Since 1991, the Authority has provided assistance to more than 30 customer community schools (see Table 3.3). All schools receiving assistance must use the MWRA wastewater curriculum and have an MWRA school program staff person give a classroom presentation either before or after the trip.

In 1994, the MWRA's new sludge pellet product, Bay State Organic, was made available to classrooms in planter kits. By using the kits in their science class, students can compare plants grown with sludge pellets to those without fertilizer, and can learn more about the benefits of recycling a waste that was formerly an ocean pollutant.

Envirolab Grants

Arlington	Ottoson J.H.S.
Boston	Bay Cove Elementary School, Charlestown H.S., Fenway Middle College, Holland School, The Learning Project, Umana/Barnes, South Boston H.S.
Braintree	Archbishop Williams
Brookline	Lincoln School
Cambridge	Rindge & Latin
Chelsea	Chelsea H.S.
Dedham	Dedham H.S.
Everett	Parlin J.H.S.
Framingham	Framingham H.S., Marian H.S.
Hingham	Hingham H.S.
Lexington	Diamond M.S.
Milton	Milton H.S.
Natick	Wilson M.S.
Needham	Pollard M.S.
Newton	Brown M.S., Countryside School
Quincy	Atlantic M.S., Broadmeadows M.S., Central M.S., Quincy After School Day Care, Quincy H.S., Woodward School for Girls
Revere	Garfield Community Magnet School
Somerville	St. Clements H.S.
Wakefield	Wakefield H.S.
Walpole	Bird M.S.
Waltham	JFK M.S., South M.S., Waltham H.S.
Winthrop	Winthrop H.S.

Table 3.3

Intergovernmental relations

Every year over a hundred pieces of legislation are filed relating to the MWRA, not counting dozens of amendments to state budgets and supplemental spending bills, requiring constant vigilance. Table 3.4 shows major legislative accomplishments from 1990 to 1994.

The 1991 state budget included an "outside section" instituting a $.00015 per gallon "fee" for Quabbin water to be paid by MWRA ratepayers. In opposition to this action, MWRA service area legislators united and formed the MWRA legislative caucus. This coalition, led by Representatives William Cass (D-Wakefield) and Robert DeLeo (D-Winthrop) and Senator Thomas Birmingham (D-Chelsea), fought successfully to repeal these provisions, the first legislative volley in what became the rate relief campaign.

The MWRA continues to work closely with the caucus on rate relief issues. For the 1995 legislative session, state debt service assistance remains a top priority. Another legislative issue is developing legislative support for state financial assistance in order to construct the MetroWest Water Supply Tunnel (see page 23). Additional issues include obtaining approval for capital projects when permission is needed under Article 97 of the state constitution for easements through or under parkland, as well as raising the statutory limit on MWRA debt.

Major MWRA Legislation 1990-1994

1990
Chapter 145—Authorized the Town of Bedford to become an MWRA water customer
Chapter 150—Raised the bond cap to $2.0 billion
Chapter 178—Transferred land for the Commercial Point CSO facility

1991
Chapter 41—Transferred property for a sludge landfill in the Town of Walpole
Chapter 101—Authorized easements for the Wellesley Extension Sewer
Chapter 138—Directed the MWRA to pay a fee for water delivered from MDC watershed land (later repealed)
Chapter 499—Raised the bond cap to $2.3 billion

1992
Chapter 36— "The Cohen Bill" provided protection measures for the Quabbin and Wachusett watersheds
Chapter 133—Directed MWRA to pay the Commonwealth $80 million for watershed costs and raised the MWRA assessment for the Division of Watershed Management
Chapter 151—Raised the bond cap to $2.6 billion

1993
Chapter 42—Authorized easements for the Winthrop water line to Deer Island
Chapter 110—Directed the Advisory Board to develop a new sewer rate methodology; allowed some town water and sewer charges to be transferred to property tax levy; created the Commonwealth Sewer Rate Relief Fund, which provided $19 million in debt service assistance to MWRA ratepayers
Chapter 422—Authorized easements for the New Neponset Valley Relief Sewer

1994
Chapter 60—Authorized $40 million for the Commonwealth Sewer Rate Relief Fund, of which $27 million went to assist MWRA ratepayers; raised the bond cap to $3.0 billion; endorsed the Advisory Board's new sewer rate methodology and implementation schedule
Chapter 132—Authorized easements for the Framingham Extension Relief Sewer

Table 3.4

Oversight

The legislature created the MWRA and maintains ultimate oversight over the agency. In addition to the Advisory Board, the State Auditor, Inspector General, and House and Senate Post Audit and Oversight Committees all exercise constant review over a wide variety of MWRA programs and transactions. The Authority reports monthly to the federal court overseeing the Boston Harbor case, and responds to hundreds of media inquiries and public information requests per year.

Promoting Workplace Excellence

Ten years ago, a tiny MWRA transition team inherited about 750 MDC water and sewer operations personnel with no central systems to support them. Many of these employees had kept the antiquated water and sewer systems entrusted to their care functioning with meager resources and even less public support. Over the past decade, they have been joined by about 1,000 others to form a workforce worthy of the assets which have been entrusted to the Authority. One of the MWRA's most important goals has been to develop its human resources to assure that its employees perform to the highest standards in fulfillment of the Authority's public service mission to its ratepayers.

Employee development

The Authority seeks to improve individual, group and organizational effectiveness through integrated training, organizational development and career development programs. Employees who participate in these training and development activities sharpen the skills to perform their duties, keep up with the technical program in their fields, and obtain professional certifications and licenses that provide the foundation for advancing their own careers.

Employee participation in an increasing number of training programs developed by the Authority has grown substantially in the past five years, as shown in Table 4.1. (These programs are in addition to the Deer Island training program described on page 4.)

Training and Development FY90-FY94

	FY90	FY91	FY92	FY93	FY94
Participants	668	1587	962	1554	2055
Programs-Tech	6	9	7	22	17
Programs-Non-Tech	3	14	11	11	20

Table 4.1

Worker safety

In September 1992, Authority employee Scott Noonan lost his life in a manhole in a tragic accident believed to have been caused by the undetected depletion of oxygen levels. While safety has always been both an MWRA concern and priority, Scott Noonan's death galvanized all levels of MWRA management and workforce to new efforts to protect worker and system safety. Through the development of an Authority-wide framework that invites field employees and managers to join together in selecting equipment and establishing and implementing work practices, the Authority has cultivated new levels of commitment to the "safety culture" which underlies progressive workplace safety programs.

Responsibility for promoting a safe work environment is now shared across the Authority. Staff at every level of the organization participate in promoting safe work practices and all department heads have individual performance objectives addressing their responsibilities with respect to guarding workplace safety.

Much of the responsibility for addressing safety issues is vested in Divisional Safety Committees originally established in the MDC through collective bargaining. The

original purpose of these labor/management committees was to identify work hazards and recommend resolutions to these hazards. With the improved safety culture at the Authority, the focus of these committees has shifted to recommending, participating in the development of and approving a number of Authority-wide procedures. The committees act as clearing houses for all divisional safety concerns and are the vehicle for directing concerns to management and applicable safety committees for corrective action.

During FY95 each division will begin creating local safety committees at specific work sites. Such committees are already in existence for Deer and Nut Island in the Sewerage Division and the Distribution Section at Glenwood Yard in the Waterworks Division. The local safety committees identify local safety issues and concerns, advise and assist management in resolving those issues, assist in local safety training and insure that ongoing communication on safety concerns is maintained between labor and management. The committees have representation from all levels of the local sections.

Other safety committees include the Safety Steering Committee which develops objectives, sets priorities, identifies/resolves resource or policy issues, oversees activities and responds to recommendations of divisional safety committees and committees created to address specific safety concerns; and Standing Special Safety Committees including Confined Space, Lockout/Tagout, and Excavation Safety committees.

One particular accomplishment of the Authority's new safety program is the establishment of the Confined Space Academy in the spring of 1993. Using a facility constructed at Fore River by in-house forces, this program has already been credited with providing training which has saved lives. Since opening, the Academy has trained more than 600 Authority employees and more than 100 employees of MWRA customer communities. The training of community employees is part of the "Common Goals" initiative, a joint initiative of the MWRA and the Advisory Board.

Labor relations

Eighty-four percent of the Authority's employees are now organized into five collective bargaining units represented by four different unions: two units are represented by an alliance between the United Steelworkers of America (USWA) and the National Association of Government Employees (NAGE); one by the Massachusetts Organization of Scientists and Engineers (MOSES); one by NAGE; and one by the American Federation of State, County and Municipal Employees (AFSCME).

In November of 1991, the USWA filed a petition with the Massachusetts Labor Relations Commission seeking to represent almost all of the then 600 non-union employees. Three other unions later joined the USWA and the process of litigation and negotiation with the Authority began. In November 1993, an agreement was reached and a consent election resulted in the selection of combined USWA and NAGE union to represent the new bargaining unit 1 (support personnel) and unit 6 (administrative professionals). In June 1993, the Authority executed collective bargaining agreements with AFSCME and NAGE which will expire in March and June 1995, respectively. Negotiations and litigation with MOSES over the remaining positions and other issues are ongoing.

Employee recognition and communication

The Employee Recognition Program was established in 1990 to recognize employee achievement. A committee was chosen from inter-disciplinary groups with union and non-union representation. Categories of recognition and standards for qualification were established, including recognition for years of service, given in five year increments (5 to 45), and recognition for excellence in performance and extraordinary service (by nomination). Since the program began, approximately 1,000 employees have been recognized for years of service, 117 for excellence in performance, and 41 for extraordinary service.

This Week, the employee newsletter, is the primary vehicle for internal communications at the Authority. It is published weekly and distributed to all MWRA employees and retirees. In 1992 the Authority began a "Brown Bag Lunch" program to supplement the internal communication that takes place through departmental staff meetings, *This Week* and other channels. The program provides an informal opportunity for the exchange of information between senior management and the employee contingents at various field sites and provides a forum for voicing ideas, concerns and/or questions. Tours of Authority facilities are another important means by which employees improve their own performance by developing a better understanding of the overall service mission of the Authority.

Internships and partnerships

In addition to traditional channels of cooperative educational opportunities, usually through area engineering programs, the MWRA has developed a number of partnerships and innovative programs over the past five years to encourage community involvement in the work of the Authority and to provide employees with avenues for community service.

The Authority's summer internship program provides work opportunities for young people interested in the environment. Through such organizations as the Boston Private Industry Council, Jobs for Youth, the Winthrop school system, City Build, Roxbury Multi-Service Center, Mayor's Youth Leadership Corps, and the Environmental Diversity Forum, the Authority provides students the opportunity to gain hands-on experience and knowledge about the environmental field of work. An average of 100 students participate each summer.

In 1993, the Authority worked with City Year, the nationally acclaimed youth service corps, to conduct an intensive outreach campaign encouraging inner-city residents to participate in "Operation Watersense", the Authority's residential water conservation program. More than 10,000 households were contacted through this effort. Also in 1993, the MWRA and The Boston Harbor Association launched an innovative program called "Harbor Bound". Since its inception, more than 750 youths have participated in a tour of Boston Harbor and the construction site at Deer Island.

In keeping with the Governor's Executive Order and a state law passed in 1993, the MWRA Volunteers in Service to Education (VISTE) program allows employees to donate up to seven hours per month to work on education-related projects. Launched in 1994, the VISTE programs offer a wide range of opportunities for students to become involved in the environmental field and to focus on various careers and social issues. Activities range from the AquaSmarts program to a program to educate students at Framingham's Stapleton School about the MetroWest Tunnel project, part of which is scheduled for construction in their community.

Diversity in the workplace

Since its creation, the Authority has committed to the principles of equal opportunity and affirmative action and has actively implemented programs and activities that promote diversity within its workforce and workplace. The Authority expects these values to govern the relationships established with the communities it serves and others with whom it does business. To that end, employees are expected to take personal responsibility for conducting Authority business in an atmosphere which encourages the fullest utilization of talent, commitment and creativity for a diverse workforce.

Affirmative action and compliance. In accordance with the Enabling Act and in compliance with its commitment to the principles of equal opportunity and affirmative action, the Authority continues to monitor the implementation of the Affirmative Action Plan that is reviewed and approved by the Board every three years. The Authority has achieved steady progress in increasing the representation of minorities, females, individuals with disabilities and Vietnam-era veterans in its workforce (see Table 4.2).

Minority and Female Representation

Year	Total Employees	Females		Minorities	
		#	%	#	%
1985	746	70	9.0	55	7.0
1989	1466	320	21.8	229	15.6
1994	1718	434	25.2	307	18.0

Table 4.2

The Authority has designated an Americans with Disabilities Act (ADA) Coordinator, undertaken an Authority-wide compliance analysis and developed a transition plan to bring the Authority into compliance with the requirements of the Americans with Disabilities Act of 1990. The availability of statistical data for Vietnam-era veterans and individuals with disabilities is contingent upon individual employees voluntarily self-identifying. Table 4.3 indicates the representation in the Authority's workforce for these two protected class groups as of July 1994.

	Vietnam era Veterans	Individuals with Disabilities	Total Employees
FY94	132 (7.6%)	102 (5.9%)	1718

Table 4.3

MBE/WBE program. The Authority's Minority Business Enterprises/Women-owned Business Enterprises (MBE/WBE) Program was established pursuant a mandate in its Enabling Act, as well as Massachusetts Executive Order 237 and the Federal Environmental Protection Agency's policy to award a fair share of subagreements to small, minority and women-owned businesses.

In the eight-year period of the program, the Authority has secured $396.3 million in services from MBE/WBEs (see Figure 4.1). A major portion of these dollars has been spent with Massachusetts-based businesses. Throughout this period the Authority has continued to refine and enhance its compliance monitoring and tracking systems. In FY94 Authority staff monitored more than 200 contracts and conducted 422 site visits. The representation of minority and female workers on the Boston Harbor Project during FY94 was 11.36% and 3.03% respectively.

MBE/WBE Participation in Contracting Opportunities FY87-94

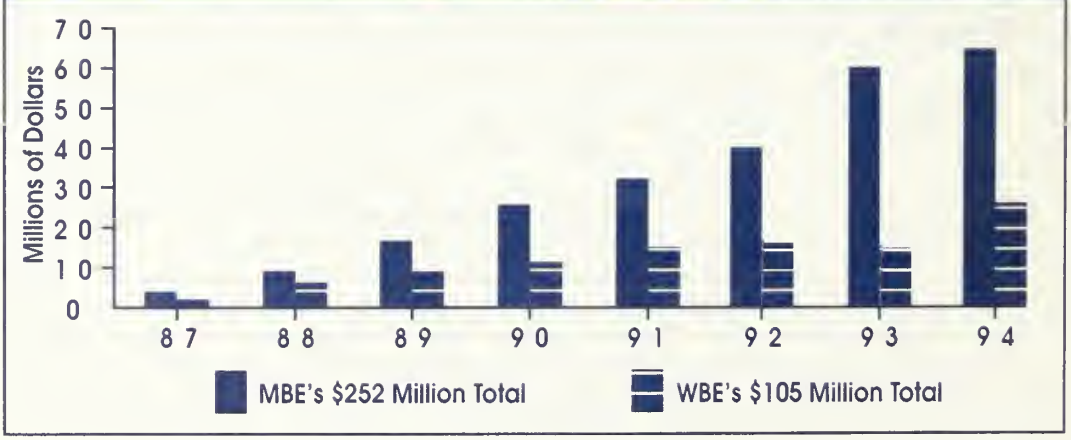


Figure 4.1

The MBE/WBE Program's goals are based on a 1990 Disparity Study conducted after 1989 United States Supreme Court decision, "City of Richmond v. J.A. Croson," raised issues regarding whether public entities could require contractors to set aside specific dollars for MBE/WBE's without proof that these groups were the victims of past discrimination and evidence that a set-aside program would remedy past discrimination. As a result, the Authority engaged a consultant to conduct a Disparity Study and report findings relative to pre-existing discrimination of MBE/WBEs. Based on that study's recommendation and subsequent Board approval, the Authority established the MBE/WBE procurement goals outlined in Table 4.4.

MWRA MBE/WBE Procurement Goals

Procurement Category	MBE%	WBE%
Construction	8.25	2.09
Professional Services	11.44	8.25
Non-Professional Goods & Services	2.20	8.25

Table 4.4 **Table 4.4**

Retirement system

All MWRA employees are members of a contributory retirement system, either the State Employees' Retirement System (for former MDC employees) or the MWRA Retirement System. The MWRA Retirement System has a membership of 1551 employees. As of June 30, 1994, the Authority had accrued approximately $32 million in pension benefit obligations. The Retirement System is governed by a three-member board, and is served by a full-time staff of three.

Meeting Continuing Challenges

The MWRA has accomplished much in its first decade. At times, however, it seems as if the successes of the past ten years are still dwarfed by the challenges yet to come. This section outlines some of those challenges.

Finishing Deer Island

As this report goes to print, the MWRA is closing in on the start-up of the first phase of the new primary treatment plant at Deer Island. While this activity will mark another major milestone in the restoration of Boston Harbor, completing the Deer Island treatment plant continues to present significant challenges, including the difficult logistical, engineering and construction demands related to the size of the plant and the location and space limitations of the Deer Island site. Other ongoing challenges include meeting permitting requirements relating, among other things, to Clean Air Act compliance, construction, occupancy and the start-up and operation of the new plant. The project has required and will continue to demand coordination and cooperation with other public agencies in many areas. Because of its size and complexity, this project also continues to require unusual levels of coordination among numerous contractors and trades.

Tunnels. Special complexity is also presented by the two large under-harbor tunnels required by the plant. While significant progress has been made on the inter-island sewage conveyance tunnel, the contractor is more than a year behind the planned construction schedule due to operational problems and difficult geological conditions. The MWRA now expects the inter-island tunnel to be completed in 1996. Progress on the effluent tunnel, while continuing steadily, has also fallen behind the planned construction schedule, due primarily to problems with the operation of the tunnel boring machine. The Authority projects completion of the outfall tunnel to be not before mid to late 1997. As a result of tunnel delays, the Authority must implement an "exigency plan" to address the impact of bringing south system flows to the new Deer Island plant for treatment and discharge prior to the completion of the long outfall.

Finalizing plant sizing, permitting the new outfall and contingency planning. In January 1995, the MWRA Board will vote on the filing of a Notice of Project Change with the state's MEPA Unit in order to finalize the recommendation to change the four-battery secondary treatment configuration envisioned in the 1988 Facilities Plan. Court approval of the change will also be necessary. In the spring of 1995, the Authority will be working with EPA, DEP and others to finalize a discharge permit for the new outfall, and a contingency plan to address unforseen technical and/or environmental impacts. The permit and the contingency plan will be the subjects of intense public scrutiny.

Public access plan. When the construction of the new treatment plant on Deer Island is complete, approximately 75 acres of new open space will be added to the inventory of publicly accessible urban waterfront sites along the shores of Boston Harbor. The open space will also provide ratepayers and neighbors a close-up view of the new treatment plant with the Authority's investment. In 1994, the MWRA prepared a draft public access plan for the island, incorporating regulatory requirements along with the views of environmental, civic and other interest groups, and the communities of Winthrop and Boston. Full access will be provided around the periphery of the island, with over two and a half miles of public walkways and trails throughout the northern and western landforms, and opportunities to place monuments to Native Americans, Irish immigrants and others who were part of Deer Island's often tragic history (see map - Appendix 5). Access by water will be strongly encouraged. Final programming for public use of a portion of the historic steam pump station, now used for a reception and training facility, is not yet complete. The MWRA hopes to work with

cultural institutions and others to raise funds for educational exhibits and programming in the visitors' center. The site was mentioned in a 1994 draft National Park Service study on a Boston Harbor Islands National Recreation Area.

Finalizing the CSO plan

After over a decade of planning and substantial interim improvements, the Authority is poised to complete one of the major elements of its pollution control agenda. The draft conceptual CSO Control Plan, completed in September 1994, is currently under consideration by the EPA, other parties in the Boston Harbor Case and the public. Although the new plan is scaled back from the Authority's 1990 tunnel plan in terms of size and cost, it remains a large and aggressive public works improvement program with significant project management and institutional challenges. The new plan includes many different projects to be constructed at various sites throughout the CSO area, and the projects cover a wide range of CSO control technologies. The plan also requires well coordinated and managed joint efforts by the MWRA and the four CSO communities - Boston, Cambridge, Chelsea and Somerville - within which CSO discharges are found.

The Authority is now formulating a plan by which the recommended improvements will be implemented. Implementation involves facilities planning/environmental review, design and construction of the dozens of small and large recommended improvements at a total estimated capital cost of $370 million. A schedule for implementation will be negotiated with the parties to the Boston Harbor Case and proposed to the federal court. Full implementation of the CSO Control Plan is anticipated to take up to 16 years.

Approval of the recommended CSO Control Plan by state and federal regulatory agencies is contingent upon the establishment of partial use designations for the various receiving water segments where treated and/or infrequent CSO discharges will remain under the plan. The partial use designation process, which is managed by DEP, involves formal MEPA review of proposed revisions to the State Water Quality Standards for those receiving water segments. The Authority anticipates that the partial use designation process will be conducted in parallel with facilities planning and MEPA review of the CSO projects.

The state Executive Office of Environmental Affairs and the Charles River Watershed Association have initiated programs to conduct watershed planning for the various Boston Harbor tributaries affected by CSO and non-CSO pollution. The watershed planning programs are expected to be conducted over the next decade. The Authority has already provided financial and technical support, and will play an important role through the duration of these efforts.

Expanding the pellet plant/ marketing Bay State Organic

Under the federal court schedule, the sludge-to-fertilizer plant at the Fore River Staging Area was originally designed as an interim facility, with only enough processing capacity to handle the volumes of sludge expected to be generated by the Deer Island plant's four primary treatment batteries. However, late in the design process the decision was made to site the permanent facility at the FRSA. The building was therefore designed to be large enough to accommodate the additional equipment that will be required to process all the sludge, including secondary treatment facility sludge, ultimately generated by the new treatment plant.

The expansion and modification of the sludge processing facilities is currently designed to include:

- upgraded and expanded sludge dewatering
- the addition of two dryer trains to the four existing trains
- improved sludge cake loading facilities
- additional pellet storage silos
- safety modifications
- changes in air handling systems for better pollution control and energy efficiency.

The Fore River plant continues to process all the Authority's sludge while it is being converted to its long-term configuration. On the near horizon, the MWRA is faced with decisions about continued contracting for plant operations. Several options are currently under consideration, including rebidding the contract, "unbundling" some of the services from each other before rebidding, or having Authority staff take over some of the operations.

As shown in the earlier section on residuals management, the combined efforts of the current contract operator (NEFCo) and the Authority resulted in the cessation of ocean discharges of sludge in December 1991, and the progression from 42% of sludge solids beneficially used in 1992-1993, to 79% beneficially used in the first eleven months of 1994. While fluctuations are likely, this overall positive trend toward greater beneficial use is expected to continue. The contract operator will continue to be responsible for the bulk of product placement. Much of the market for the fertilizer is expected to remain outside Massachusetts and New England, in regions where large-scale commercial agriculture is practiced. A much smaller but still important aspect of product marketing will be the direct efforts by MWRA staff to promote the use of Bay State Organic as a specialty fertilizer, particularly within Massachusetts.

Implementing the new sewer rate methodology

FY96 will mark the introduction of a new methodology for apportioning the Authority's sewer rate revenue requirements to its 43 sewer customer communities. Unlike the current methodology which is based on population and population equivalents, approximately 70% of the sewer charges under the new methodology will be driven by metered community wastewater flows and loads, with the remaining 30% based on community census and sewered population.

Because the new methodology is based primarily on flow, most communities view it as being more fair and equitable. However, some communities' confidence may erode due to year-to-year variations, especially among those who do not yet fully understand the implications of the switch to flow-based rates. Therefore, it is critical that the Authority manage its wastewater metering system and the interpretation of the data it provides with the utmost precision. Communities must also be provided with the opportunity, through the "Rate Basis Review and Comment" process, to review and challenge the data used to calculate rates.

A proactive public information process will be the Authority's best tool in addressing questions and concerns regarding flow variability and the resultant impact on community charges as calculated using the new sewer rate methodology.

Controlling future rate increases

As the Authority enters a new era and prepares to meet the challenges of the next several years, the reality of resource constraints must be factored into future planning. For the past several years, the Authority has been successful in implementing a rates management strategy which has resulted in moderate, and in this year, no growth in wholesale rate charges following a period of steep increases. Today, the MWRA is attempting to meet a rates management goal set by the Advisory Board of not more than 5% increases for FY96 and FY97. For the remainder of the decade, current forecasts include large increases to finance the completion of the Boston Harbor Project and begin construction of a water treatment facility and the MetroWest Tunnel. Yet additional resources to meet the new operating and system rehabilitation needs will be hard to muster. At the same time as the Authority pursues outside sources of funding, it must also achieve greater efficiency and productivity within current resource levels in order to meet higher service delivery goals. To successfully meet the challenges presented by new facilities, system rehabilitation, improved operations and maintenance and rates management, the Authority must plan and execute its future action with greater precision and discipline than ever before.

Estimated rate increases for the next five years reflect continued spending of an additional nearly $400 million each year on new capital projects, as well as on new

operating costs associated with operating the new Deer Island treatment plant - a new service to ratepayers. The range of estimated increases (from 52% to 64% increase over FY95 amounts) depends upon a number of uncertainties, but key elements are the rate of inflation in construction costs, the cost of additional borrowing, the actual cost of chemicals and utilities at Deer Island. A critical element of controlling rate increases will be the continued infusion of federal grants, SRF subsidies and state debt service assistance. Given approximately $130 million in additional state taxes generated annually by the Boston Harbor Project, and the critical nature of the water and sewer infrastructure at stake, inclusion of MWRA rate relief in state financing plans should continue to be warranted.

Shifting from facilities construction to operation

During the next ten years, the Authority will shift its orientation from an ambitious program of $4.5 billion worth of capital improvement projects, to a sustained effort to steward the new system assets and to extend the useful life of older facilities as long as possible. If the Authority is to avoid the operational failures and environmental problems that led to the creation of the Authority ten years ago, an adequate level of funding for the less visible but crucial operations and maintenance programs must be assured. Maintenance has always played an important role in the Authority's budget, beginning with correction of severe problems in facilities inherited from the MDC, and it will continue in importance in order to minimize capital replacement of the new and existing facilities.

To guide the transition, the Authority has created the Planning and Coordination Department, which has embarked on a long range strategic planning effort to be embodied in a Business Plan. The plan will guide decision-making in light of the financing challenges presented by the costs of completing new facilities, the additional costs of meeting their operating needs, and the costs of returning neglected components of the system to good working order.

The MWRA can also learn lessons from other water and wastewater agencies that provide high quality services and have reputations for efficient operations. A Benchmarking Study will be conducted this spring to identify the best practices in these agencies that enable management to improve performance, increase value to customers, and reduce cost. Results from the survey will help set goals for the Authority to become more efficient in service delivery and more productive in its physical operations.

Managing facility needs

As the Authority has invested in improved maintenance and repair of its systems, maintenance staff have grown from 80 to 300 employees and heavy equipment has been purchased. The commitment to system maintenance now requires that the inherited maintenance facilities be upgraded to accommodate these changes. The Authority plans to consolidate maintenance operations at three sites, down from the existing eight locations. Consolidation will increase efficiency through improved staff utilization, sharing of equipment and greater management control.

Some major waterworks structures and equipment are in need of improvement or replacement primarily due to their age. Substantial capital expenditures will be made over the next 10 years to upgrade and modernize the existing pumping stations and a program to standardize facility design, operating components, and installation details is being implemented.

Waterworks distribution system maintenance crews are currently working out of severely overcrowded, inadequate facilities at Mystic Shops, Linden Street, Chestnut Hill and Glenwood Yard. The Authority is in the process of procuring a new site for these crews, along with waterworks shops and the vehicle maintenance satellite center. Completion of a new North Distribution Maintenance Facility, proposed for a former Everett DPW yard site, will open up space for use by the Sewerage Division and allow the Linden Street lease to expire. Given the opportunity to consolidate at Everett, the Authority will have minimal long term needs at the Chestnut Hill site. Consequently,

the Authority is beginning a planning process with a variety of external constituencies interested in the future of the Chestnut Hill site.

Redeveloping the Fore River Staging Area

The MWRA has been diligent in minimizing the ratepayer's investment in the infrastructure and systems at the Fore River Staging area (FRSA). The MWRA has already internally surplused the 100 acres being made available for shipbuilding reuse and more acreage will follow after 1996. The Redevelopment Plan for the FRSA must be funded and implemented with the timing of the implementation determined by the phasing out of the land/building needs for the Boston Harbor Project.

As of this writing, progress has been made on the initial reuse efforts, although there is much work ahead and there are numerous pitfalls. The uses agreed to in the plan include shipbuilding/ship repair, educational/cultural/tourism, and a marine technology center. The ongoing lease negotiations with Northeast Shipbuilders Inc. (NSI) will hopefully mean the return of shipbuilding to the site. The timing of the reuse activities will also be crucial in terms of deferring some capital expenses that can be anticipated. However, each of these efforts is subject to the vagaries of funding and support. The facility's use as a shipbuilding site effectively ended in 1986. Therefore, there are some deferred maintenance issues that will need to be addressed if the shipbuilding lease does not come to fruition or if the redevelopment activities are postponed for too long.

The Authority's mitigation agreements with the City of Quincy and the Town of Braintree, which expire in 1995, must be renegotiated within the changing context of activity at FRSA.

Completing waterworks facilities and implementing watershed protection plans

Capital spending on the Waterworks system, which has been overshadowed for a decade by the Boston Harbor Project, will soon emerge as a significant budgetary factor for the Authority. In fact, approximately 50% of the Authority's $2.6 billion capital budget for the period FY96-2005 will be earmarked for waterworks projects. Several major waterworks projects are near on the horizon, and much construction is proposed to occur during the next ten years. Major projects include:

- MetroWest Water Supply Tunnel
- Wachusett Reservoir Water Treatment Facilities
- Covered Distribution Storage Facilities

Conducting these projects requires careful, intelligent engineering to make sure that all the pieces will fit together and operate properly as part of a unified system. Limited staff resources must be applied skillfully to plan, coordinate, and manage this work within available means. All the while, the water system must remain in continuous operation, as major components are added and others taken off-line.

The Authority is moving towards finishing design of the MetroWest Tunnel, and the project will essentially be ready for construction within about a year. Because the project protects statewide economic and public safety interests, state funding assistance is being sought via a bill filed for the 1995 legislative session.

The Wachusett Reservoir Water Treatment Facilities present a range of challenges. The Authority is currently designing two different water treatment plants and has until 1998 to prove that the more expensive filtration option is not required, by working with the MDC to improve water quality in the reservoir. Among the most critical pollution problems requiring attention is that of failing septic systems in West Boylston and Holden. The MDC has developed a solution plan involving replacement sewers, at a cost of more than $50 million. Determining the appropriate non-ratepayer funding sources will be an important challenge for all parties concerned.

Another factor affecting treatment planning is the possibility that water quality standards will change and become more stringent in the years ahead. Already there are

indications that the Surface Water Treatment Rule will be enhanced to provide protection against *cryptosporidium*, the cyst that caused the massive disease outbreak in Milwaukee in 1993. As science discovers more pathogens and chemicals of concern at smaller and smaller concentrations, the Authority will face greater challenges in remaining in the small class of unfiltered systems.

The provision of covered distribution storage will cost the MWRA more than $200 million during the next 10 to 15 years. The Authority recognizes that any type of construction and alteration around open water bodies in urban areas is environmentally sensitive. The Authority is committed to working with neighbors, interest groups, and local officials to arrive at acceptable options which preserve important environmental and aesthetic values and yet support mandated goals for safe drinking water.

Upgrading the southern sewage interceptor system

There are two major problems with the southern sewage interceptor system: current system deficiencies and future service population growth. Upgrading the system will alleviate sewage overflows to adjacent land, river and wetland areas and provide additional capacity for future population growth.

Recently, progress has been made in the four "major" construction projects. The Wellesley Extension Relief Sewer project began construction in 1989. All seven construction phases are now substantially complete. The New Neponset Valley Relief Sewer project began construction in 1993 and four of the five construction phases are currently being implemented with substantial completion planned for 1996. Major portions of these systems are in service today. The Framingham Extension Relief Sewer project is in final design with one contract currently under construction and planned for completion in 1995. Three contracts are planned to begin construction in 1996 with substantial completion planned for 1997 and 1998. A fifth contract is planned to begin construction in 1999 with substantial completion scheduled for the year 2000. The Braintree/Weymouth Relief Sewer project is currently in the design phase with eight construction phases planned for construction between 1998 and 2001. Issues relating to permitting, land acquisition, community impacts, environmental protection and construction implementation increase the complex and controversial nature of each project.

Responding to new demands on the systems

The Authority is likely to face future demands from communities outside its statutorily defined service area which will impact both operations and revenue sources. If service area issues arise, they are more likely to involve the waterworks system rather than the sewer system due to the limited options non-MWRA communities may face when confronted with local water supply problems and the MOU with Winthrop which prevents the MWRA from expanding the size of the Deer Island Treatment Plant beyond the design flow and loading capacities found in the 1988 Facilities Plan. This view is borne out by various community interactions within the past few years, including:

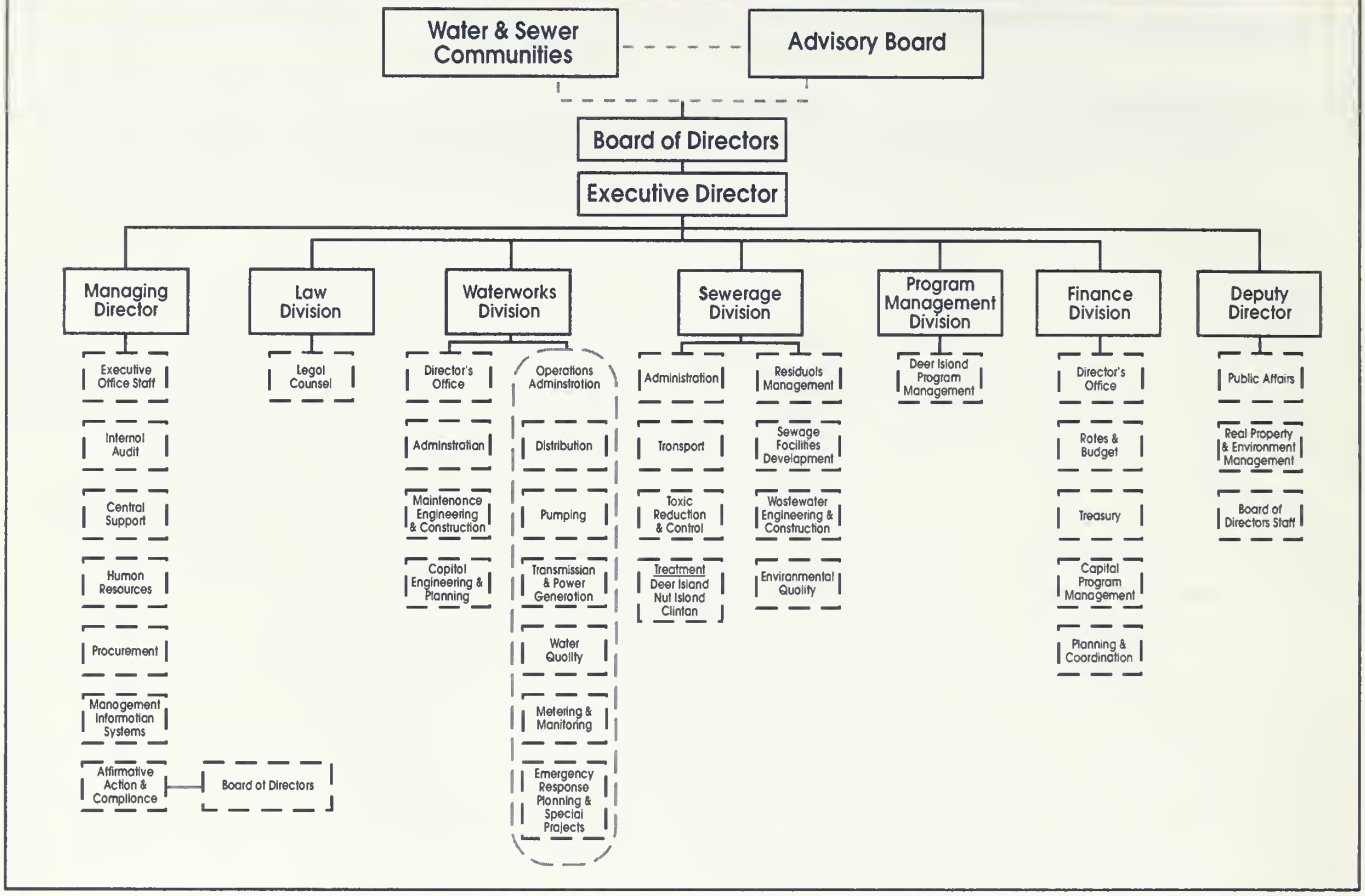
- The admission of Bedford to the water system in 1993
- A request from Stoughton for admission to the water service area
- A request from the Tri-Town System (Braintree, Randolph, Holbrook) for an emergency water supply connection in 1994.

While these kinds of matters may continue to arise at times, safeguards built into the Enabling Act ensure that the MWRA water supply system is regarded only as an alternative of last resort rather than one of convenience.

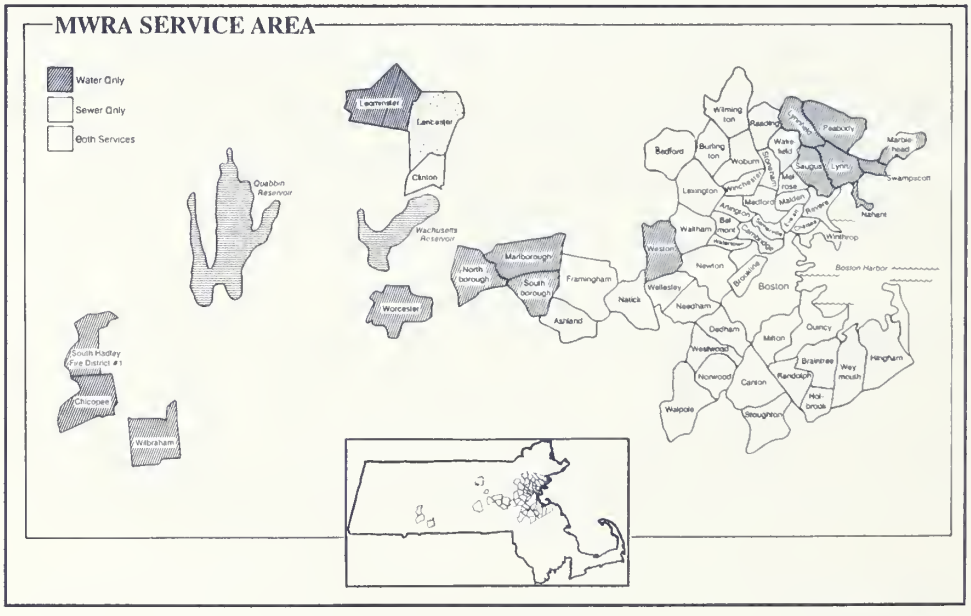
Maintaining public confidence

In meeting these and many other challenges, the Authority must be constantly aware of its obligation to the many constituents it serves. It must invest every ratepayer and taxpayer dollar wisely, and let the public know what it is getting for its money. State and federal support for rate relief, and governmental and public support for Authority programs, projects and policies, will only continue if the MWRA keeps faith with the public. The sheer magnitude of the undertaking in an era of public skepticism of government makes this perhaps the agency's most formidable challenge. Only by working together with customers and critics, advocates and auditors, and by drawing upon the strength and talent of its people can the Authority deliver on its promises.

MWRA Organizational Chart



Appendix 1



Appendix 2

MASSACHUSETTS WATER RESOURCES AUTHORITY
CAPITAL INVESTMENT SUMMARY–JULY 1994
(IN MILLIONS)

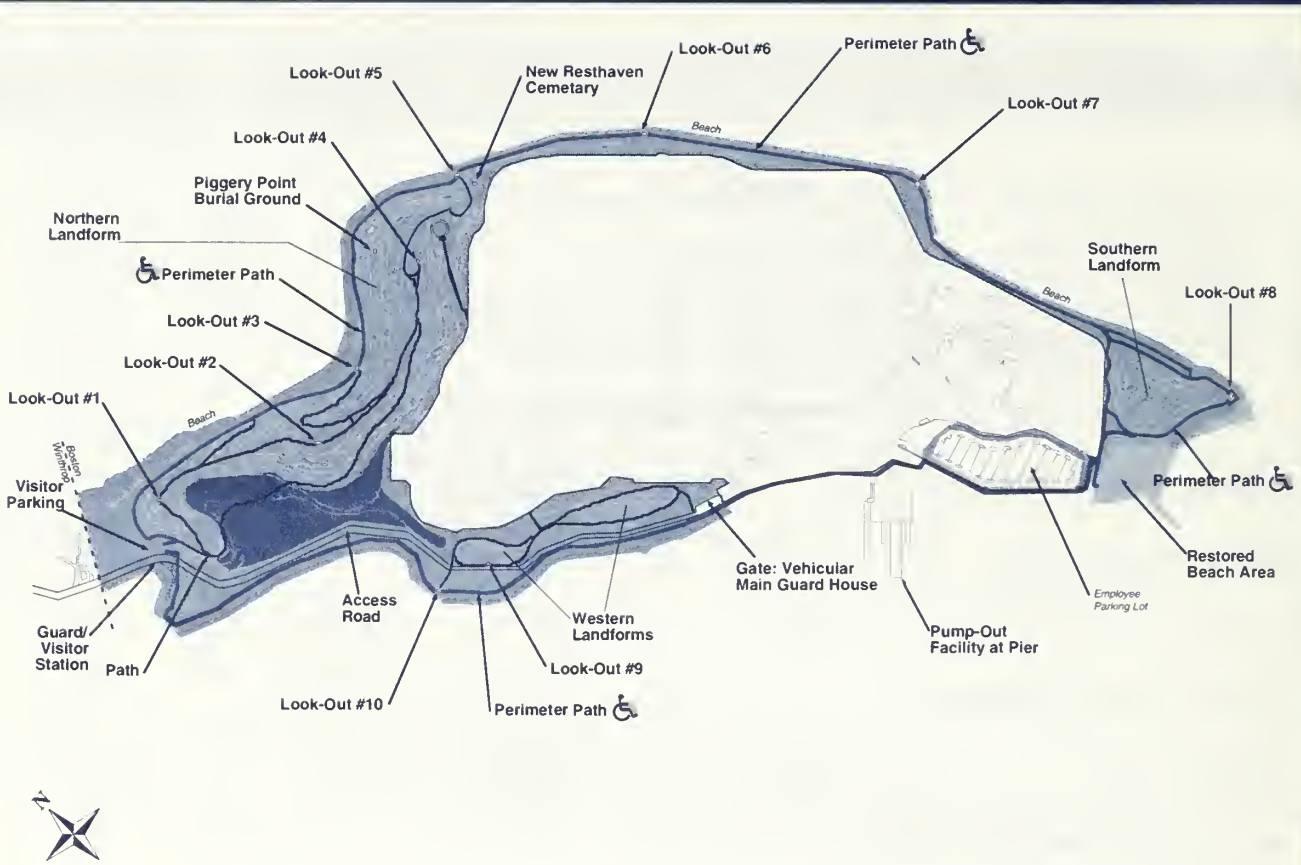
Appendix 4
"The Laskey Chart"

	Completed[1] Expenditures (FY 1986-FY 1994)	Planned[2] Expenditures (FY 1994-FY 1999)	Total Expenditures FY 1986-FY 1999 No Adjustment for FY 96-99 Construction Inflation	Total Expenditures FY 1986-FY 1999 Assumes 5% annual inflation for contract awards in FY 96-99
Boston Harbor Project				
"Fast Track" Deer Island	118	1	119	119
New Deer Island Plant [3]	1,730	1,460	3,190	3,271
Residuals Management	111	41	152	154
CSO Screening/Chlorination	16	0	16	16
Subtotal	$ 1,975	$ 1,502	$ 3,477	$ 3,560
Wastewater Pipes & Pumping	290	56	346	351
Clinton Treatment Plant	37	0	37	37
Subtotal	$ 2,302	$ 1,558	$ 3,860	$ 3,948
Combined Sewer Overflows[4]	20	82	102	117
Wastewater Total	**$ 2,322**	**$ 1,640**	**$ 3,962**	**$ 4,065**
Aqueduct Improvements[5]	38	239	277	309
Water Pipes & Pumping[6]	94	144	238	254
Filtration Plant & SDWA	5	80	85	97
Water Supply	24	12	36	39
Waterworks Total	**$ 161**	**$ 475**	**$ 636**	**$ 699**
Systems Total	**$ 2,483**	**$ 2,115**	**$ 4,598**	**$ 4,764**
Contingency	0	55	55	63
Grand Total	**$ 2,483**	**$2,170**	**$ 4,653[7]**	**$ 4,827[8]**

The MWRA issued the first 1986-1999 Capital Investment Summary in October 1992 and produces updates in February and July each year. In October 1992, the estimated cost of the capital program through FY 1999 was $7 billion. Today, the cost estimate is $4.8 billion, a reduction of $2.2 billion. The reductions are concentrated in the Deer Island Treatment Plant, CSOs and Safe Drinking Water Act Compliance Program. Deer Island costs have been lowered by $408 million due to contract awards below budget and relatively inflation. CSO costs have been reduced by $654 million through the Master Planning effort and rescheduling of the project. Safe Drinking Water Act Compliance is reduced by $697 million due to lower inflation and negotiation of a consent agreement which shifts most construction expenditures beyond FY99.

1. Completed expenditures in this column reflect payments through July 1994. "Fast Track" improvements include $22 million paid by MDC on projects completed by MWRA.
2. Size and timing of planned expenditures based on MWRA Proposed FY95-FY97 Capital Improvement Program published in August 1994. Planned expenditures in this column are valued in FY95 dollars without accounting for the effect of inflation on future-year construction costs.
3. The cost estimate for the Deer Island Treatment Plant is reduced by $43 million due to lower than anticipated inflation and use of contingency funds.
4. The Combined Sewer Overflow Control Program cost estimate is reduced by $113 million due to downsizing of CSO facilities through the new Master Planning effort and a schedule extension to allow for a second Environmental Impact Review. The Master Planning effort is not yet complete and further revision to CSO cost estimates are expected.
5. The MetroWest Tunnel project schedule has been adjusted to stretch over seven years, moving $96 million beyond FY1999.
6. The Water Pipes and Pumping program has been rescheduled to reflect realistic expectations of how much construction work can be done over the next five years. The revised schedules result in deferral of $55 million beyond FY1999.
7. The total cost of the capital program for 1986-1999 is $289 million lower than projected in the February 1994 Capital Investment Summary.
8. The Authority's projection of capital costs, in inflated dollars, is $337 million below the February 1994 estimate. The lower estimate is due to the fact that the MWRA continues to have an increasing number of projects under contract, thereby reducing inflationary allowances.

Deer Island Public Access Plan



Appendix 5

Boston Harbor Project— Secondary Treatment Facilities Sizing

Facilities under construction ar canstructed

Additianal secandary facilities required — Battery C and associated facilities

Secondary facilities not required — Battery D and associated residuals facilities

Capital cost savings: at least $165 million

Appendix 3

"Well, there's always retrospect to light a clearer path."

–E. Saliers, Watershed

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